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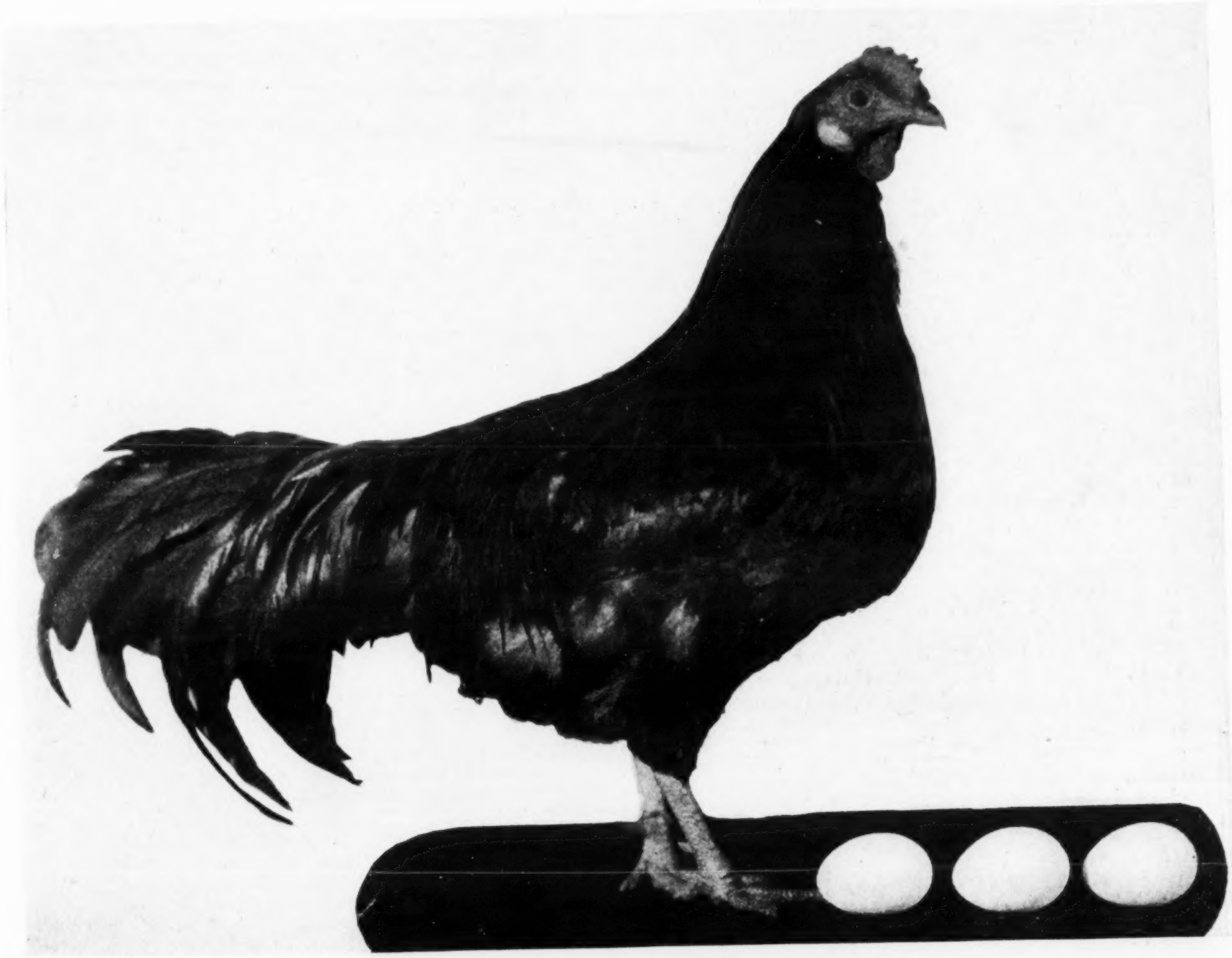

The "Rooster" That Laid

(See Page 97)

The Problem of Adaptation

Double and Triple Crowns

MARCH, 1927 Vol. 18, No. 3

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FEATHERS FROM THE "COCK" THAT LAID

Frontispiece

"Cock"and "hen" feathers from different regions of the same individual. The feather at the left in each case is the "cock" feather. The "cock" feathers are from the plumage of the bird when received in February, 1922; the corresponding "hen" feathers dated September 28 are those which replaced "cock" feathers pulled on February 17, while that dated November 10 was acquired in the fall molt. The "Rooster" was in reality a hen which for one or more molts had assumed male plumage, due in all probability to a cessation of function of the ovary. When the ovary for some reason resumed its normal activity the "cock" began to lay, and at the next molt the masquerade came to an end.

THE LAY OF THE "ROOSTER"*

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Department of Genetics, University of Wisconsin

THE tendency for hens, especially old ones, to develop male characteristics, even to the extent of usurping the male prerogative of crowing, is well known and has been for ages. Everyone is familiar with the dire prediction as to the future prospects of "whistling girls and crowing hens." The unfortunate consequences for the male of not adhering to those lines of duty and action prescribed by Nature for his sex have not, at least in the case of birds, received such general notice; nevertheless such apparent derelictions have been observed in times past and duly condemned.

Early definite records of "roosters" that so far mistook their calling in life as actually to lay eggs seem few, yet the fact that they were supposed occasionally to do so is apparent from frequent reference in ancient and mediæval literature to "cocks' eggs." Such eggs are said to have been eagerly sought by sorcerers because of their value as ingredients in certain magical preparations. What is more, according to early mythology a cock's egg if hatched gave rise to a fearsome conglomerate of a beast known as a cockatrice, often considered as identical with the basilisk. Its forward parts resembled those of its unnatural mother, the cock, while it trailed off posteriorly into the tail of a lizard or serpent. A whiff of its breath or a glance from its eye meant certain death to the unfortunate recipient. As Evans[7] says, "the unfortunate fowl, suspected of laying an egg in violation of its nature, was feared as an abnormal, inauspicious, and therefore diabolical creature; the fatal cockatrice, which was supposed to issue from this egg when hatched, and the use which might be made of its contents for promoting intercourse with evil spirits, caused such a cock to be dreaded as a dangerous purveyor to His Satanic Majesty." And further: "It was the same horror of aiding and abetting demons and enabling them to extend their power over mankind that caused a cock, which was suspected of having laid the so-called 'basilisk-egg,' or a hen, addicted to the ominous habit of crowing, to be summarily put to death, since it was only by such expiation that the evil could be averted."

A number of cases of the actual trial and condemnation of cocks for laying eggs appear to be on record, and one such which occurred at Basel, Switzerland, in 1474, is far famed. Evans (*loc. cit.*) gives an interesting account and discussion of this case which may well be quoted:

> In 1474, the magistrates of Basel sentenced a cock to be burned at the stake "for the heinous and unnatural crime of laying an egg." The *auto da fé* was held on a height near the city called the Kohlenberg, with as great solemnity as would have been observed in consigning a heretic to the flames, and was witnessed by an immense crowd of townsmen and peasants. The statement made by Gross in his *Kurze Basler Chronik*, that the executioner on cutting open the cock found three more eggs in him, is of course absurd; we have to do in this case not with a freak of nature, but with the freak of an excited imagination tainted with superstition. Other instances of this kind have been recorded, one in the Swiss Prättigau as late as 1730, although in many cases the execution of the gallinaceous malefactor was more summary and less ceremonious than at Basel.
>
> The *œuf coquatri* was supposed to be the product of a very old cock and to furnish the most active ingredient of witch ointment. When hatched by a serpent or a toad, or by the heat of the sun it brought forth a cockatrice or basilisk, which would hide in the roof of the house and with its baneful

*Papers from the Department of Genetics, Agricultural Experiment Station, University of Wisconsin, No. 65. Published with the approval of the Director of the Station.

[We owe our somewhat facetious title to a suggestion dropped casually by Mr. William Beebe when being shown the photographs here reproduced.]

breath and "death-darting eye" destroy all the inmates. Many naturalists believed this fable as late as the eighteenth century, and in 1710 the French savant Lapeyronie deemed this absurd notion worthy of serious refutation, and read a paper, entitled "Observation sur les petits œufs de poule sans jaune, que l'on appelle vulgairement œufs de Coq," before the Academy of Sciences in order to prove that cocks never lay and that the small and yolkless eggs attributed to them owe their peculiar shape and condition to a disease of the hen resulting in a hydropic malformation of the oviduct. A farmer brought him several specimens of this sort, somewhat larger than a pigeon's egg, and assured him that they had been laid by a cock in his own barnyard. On opening one of them, M. Lapeyronie was surprised to find only a very slight trace of the yolk resembling "a small serpent coiled." He now began to suspect that the cock might be an hermaphrodite, but on killing and dissecting it discovered nothing in support of this theory, the internal organs being all perfectly healthy and normal. But although the unfortunate chanticleer had fallen a victim to the scientific investigation of a popular delusion, the eggs in question continued to be produced, until the farmer by carefully watching the fowls detected the hen that laid them. The dissection showed that the pressure of a bladder of serous fluid against the oviduct had so contracted it, that the egg in passing had the yolk squeezed out of it, leaving merely a yellowish discoloration that looked like a worm. Another peculiarity of this hen was that she crowed like "a hoarse cock" (*un cok enroué*), only more violently; a phenomenon also a source of terror to the superstitious, but ascribed by M. Lapeyronie to the consequent pain caused by the passage of the egg (*Mémoires de l'Academie de Sciences. Paris,* 1710, pp. 553-60).

A Greek physiologus of the twelfth century written in verse, calls the animal hatched from the egg of an old cock επτειναρια a name which would imply some sort of winged creature. It was "sighted like the basilisk," and endowed also in other respects with the same fatal qualities.*

It is evident from the foregoing quotation that, in the opinion of Evans, the accused birds could not have been guilty of laying the eggs ascribed to them; that, in fact, the eggs were in all probability laid by a normal hen (when the eggs were normal) and that the accusation of the cock was due to "the freak of an excited imagined tainted with superstition." In the case investigated by M. Lapeyronie it would appear that the cock was indeed innocent; here the finding of the small yolkless eggs, often called "wind-eggs," combined with imagination and superstition, did lead to the accusation of an innocent victim, with a fatal result. But from what follows it seems probable that in many, if not indeed in most of the cases, the accused birds did actually lay the eggs attributed to them.

Modern Laying "Cocks"

A modern instance of a bird with the appearance of a cock, in that it had male plumage, and that laid eggs, is mentioned in notes in the *National Poultry Journal* (London) of December 16 and 23, 1921, and January 6 and 20, 1922. This bird, variously referred to as "Cock Hen," "Hermaphrodite," and "Pseudo-hermaphrodite," was exhibited at the National Utility Poultry Show at Westminster and attracted a great deal of popular interest. It was a Buff Orpington, with male plumage, as has been said, but had a head like a hen, "croaked" like a hen, and handled like a hen. It was reported to have laid eggs, but doubt was cast on this by the fact that "some practical joker determined that it should prove its capacity to lay and at different times during the last day of the show, placed in its pen a light-colored egg from a White Wyandotte and a dark brown egg from a Light Sussex. These eggs were 'found' in the pen and accordingly the bird's capacity to lay has been 'verified' by a large number of daily papers." A Mr. H. M. B. Spurr, however, convinced himself that this bird did not need clandestine assistance in order to prove its egg-producing ability. In the January 6, 1922, issue of the *National Poultry Journal* he gives the following account, addressed to the Editor:

*Evans book contains a fascinating discussion of the whole question of the prosecution and punishment of animals and the motives which lay back of it. The subject has been reviewed also by Hyde.[13]

When on duty during the Christmas vacation, at the Eyresford Training Centre, I had the opportunity of convincing myself that this "Cock-hen" does lay.

On December 22nd a fellow trainee reported that the bird had laid; and when trapnesting on the 24th I found the bird in No. 4 nest box, No. 6 pen, at 11:45 A. M. To prevent mistake I immediately took possession of the house key, locked the house, and continued my tour of duty.

Returning at 12:25 I released the bird and removed a small, but typical Buff Orpington egg.

Seeing is believing, Sir, and although previously doubtful I am now assured, in spite of the determined opinion that this "cock of the south" does not lie—it lays.

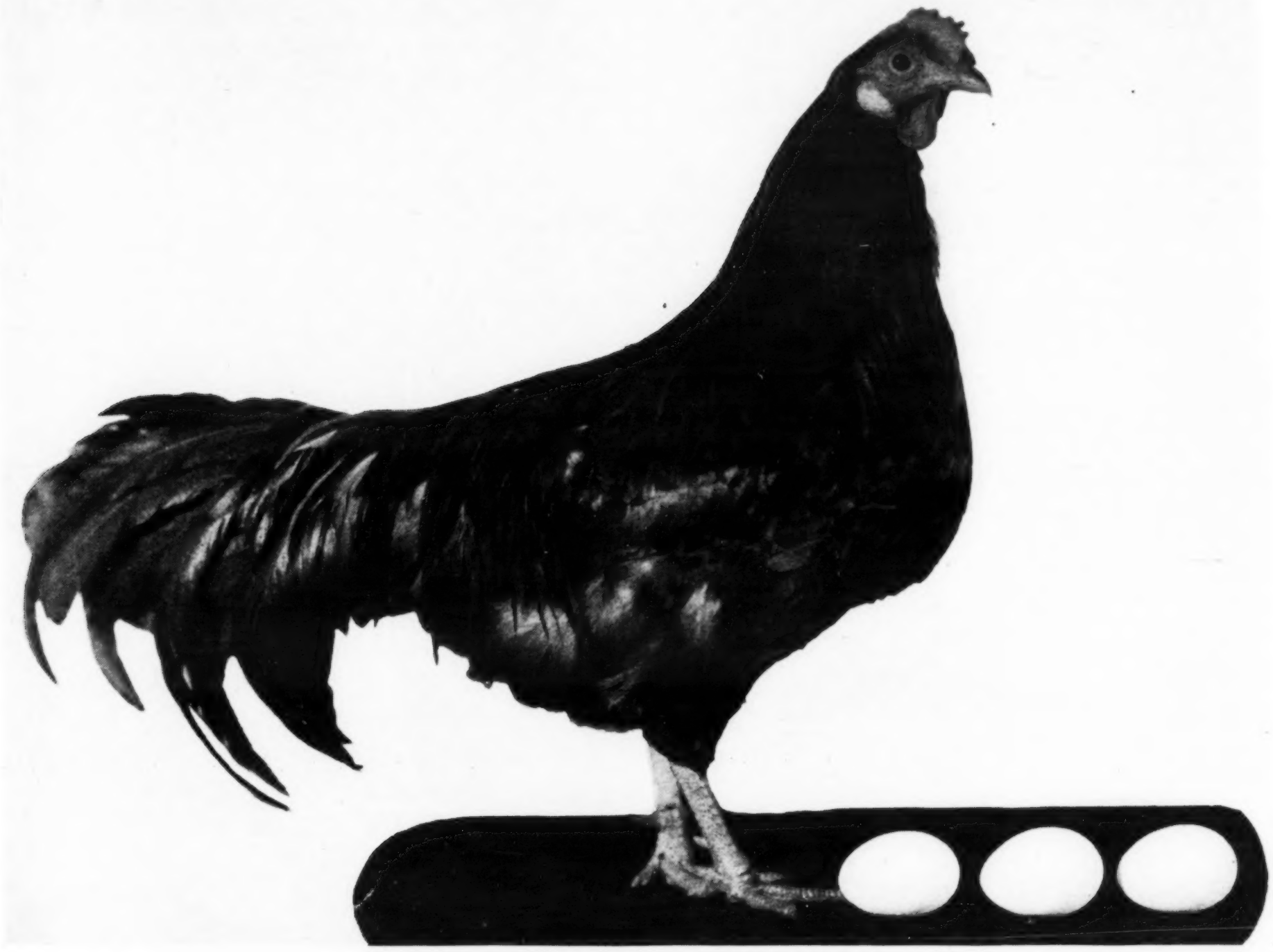
While attending a farmers' institute and poultry show in the neighboring village of Mazomanie early in 1922, Professor J. G. Halpin of the Poultry Husbandry Department of the Wisconsin Experiment Station, was told by the manager of the local poultry and egg company of an unusual bird in his possession. This bird had the plumage of a Brown Leghorn cock, but was laying eggs. He had bought it of a farmer, and as it was a great curiosity was keeping it as a "mascot." Professor Halpin, recognizing the interest of the case if authentic, made arrangements for procuring the bird and had it sent to Madison. I am deeply indebted to Professor Halpin for his generosity in allowing me to make observations on the bird, as well as for the interest and assistance of himself and Professor D. H. Reid of the Texas Agricultural College, who was at that time his colleague.

The bird, on arrival, was found to have characteristic male plumage of the Brown Leghorn except for occasional hen feathers (stippled), especially on the breast. There were practically no hen feathers in the hackle or saddle regions. There is no question that to the casual observer the bird would have passed as an ordinary Brown Leghorn cock. To one familiar with poultry, however, it was at once evident that the head was characteristically "henny" in appearance, the comb and wattles being small. Owing to the fact that the bird had a rose comb, this difference was probably less striking than it would have been had the comb been single. The general body form, moreover, was that of a female rather than a male. Spurs were strongly developed and sharply pointed as they often are in old hens; they were not curved like those of a cock.

In order to settle the question of egg production beyond any possibility doubt, the bird was placed in a padlocked wire cage in a room in the Poultry Building. It should be stated, furthermore, that the mesh of the screen on the cage was too small for the insertion of an egg into the cage except through the door. The cage was itself in a room not open to the public.

It was possible when the bird was received to detect an unlaid egg in the oviduct and the presence in the cage the following morning of an egg of normal Brown Leghorn size and color dispelled all doubt that our "rooster" could lay. Following that, eggs came at intervals of about every other day. Figure 1 is a photograph of this bird taken on February 17, 1922, together with three eggs laid on February 13, 15 and 17, respectively, in the order named from right to left. If Evans could have seen this picture he would not have been so ready to doubt that the executioner on cutting open the Cock of Basel "found three more eggs in him." Had we cut open our bird we undoubtedly should have had the same experience for "he" continued to lay regularly over a long period.

While science occasionally demands the sacrifice of animal life for the furtherance of knowledge, its advance has on the other hand saved countless lives of both animals and men from the consequences of superstitious beliefs. So instead of burning our bird at the stake, or even of putting it into a stew, we first decided on the most plausible explanation of the case and then set about to test whether it was correct. In order to make this explanation clear, however, it is necessary first to review a series of facts that have



MASQUERADING AS A COCK

Figure 1

The "rooster" that laid, and three of the eggs. Photographed February 17, 1922.

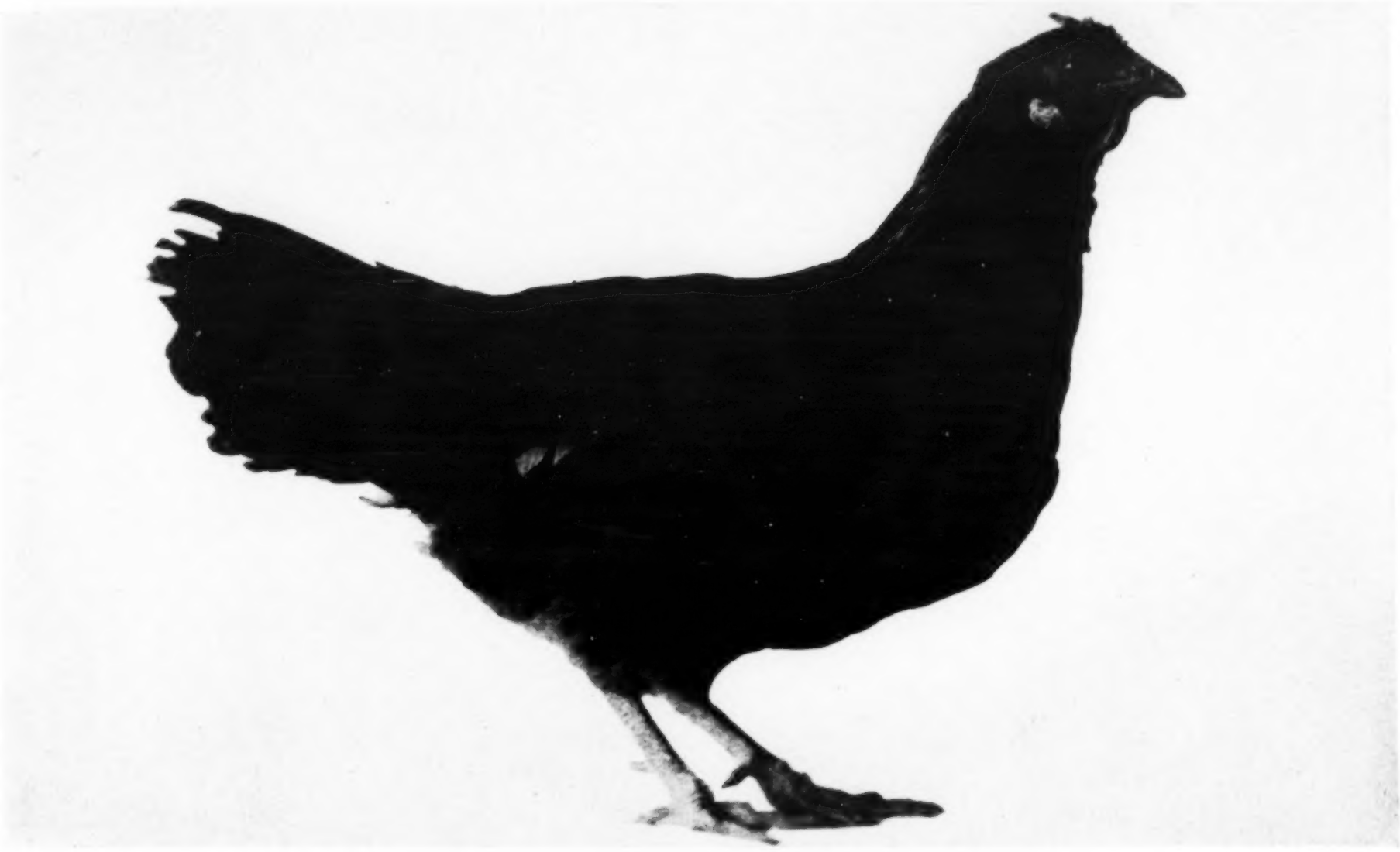
become apparent in recent years with regard to sex expression in poultry.

As was stated at the beginning of this paper, the relatively frequent tendency of hens to assume male plumage and other masculine attributes has long been observed. Recent investigations (particularly Boring and Pearl[2], and Crew[4])* show that this change is in almost all cases associated with a diseased condition of the ovary, usually a tumerous growth, and commonly assumed to be of tubercular origin. Since surgical removal of the ovary causes the assumption of male secondary sexual characters, and in particular those of the plumage (Goodale[9], Finlay[8], Domm[6]), it is not surprising that the same result should follow any condition, such as disease, which destroys the normal functioning of the gland†. The series of changes in the secondary sexual characters which accompanies ovarian tumors is indeed closely parallel to the sequelæ of ovariotomy.

In addition to the changes in the expression of secondary sexual characters there is also as a rule a profound and significant change in the sex glands themselves. This commonly takes the form of a reduction or complete cessation of the ovarian function and the

*These authors give references to earlier literature. As additional references may be mentioned Parhon and Parhon,[15] and a picture of "A hen that crowed" in the *Journal of Heredity*, Vol. 6, No. 11, 1915, p. 482. See also Dent.[5]

†The hen mentioned by Evans as having been examined by M. Lapeyronie very likely came in this category. The "bladder of serous fluid" may well have been some sort of ovarian tumor for the fact that she crowed like "a hoarse cock" would indicate disturbed ovarian function.



IN NORMAL PLUMAGE
Figure 2

The same bird photographed on November 11, 1922, after the fall molt.

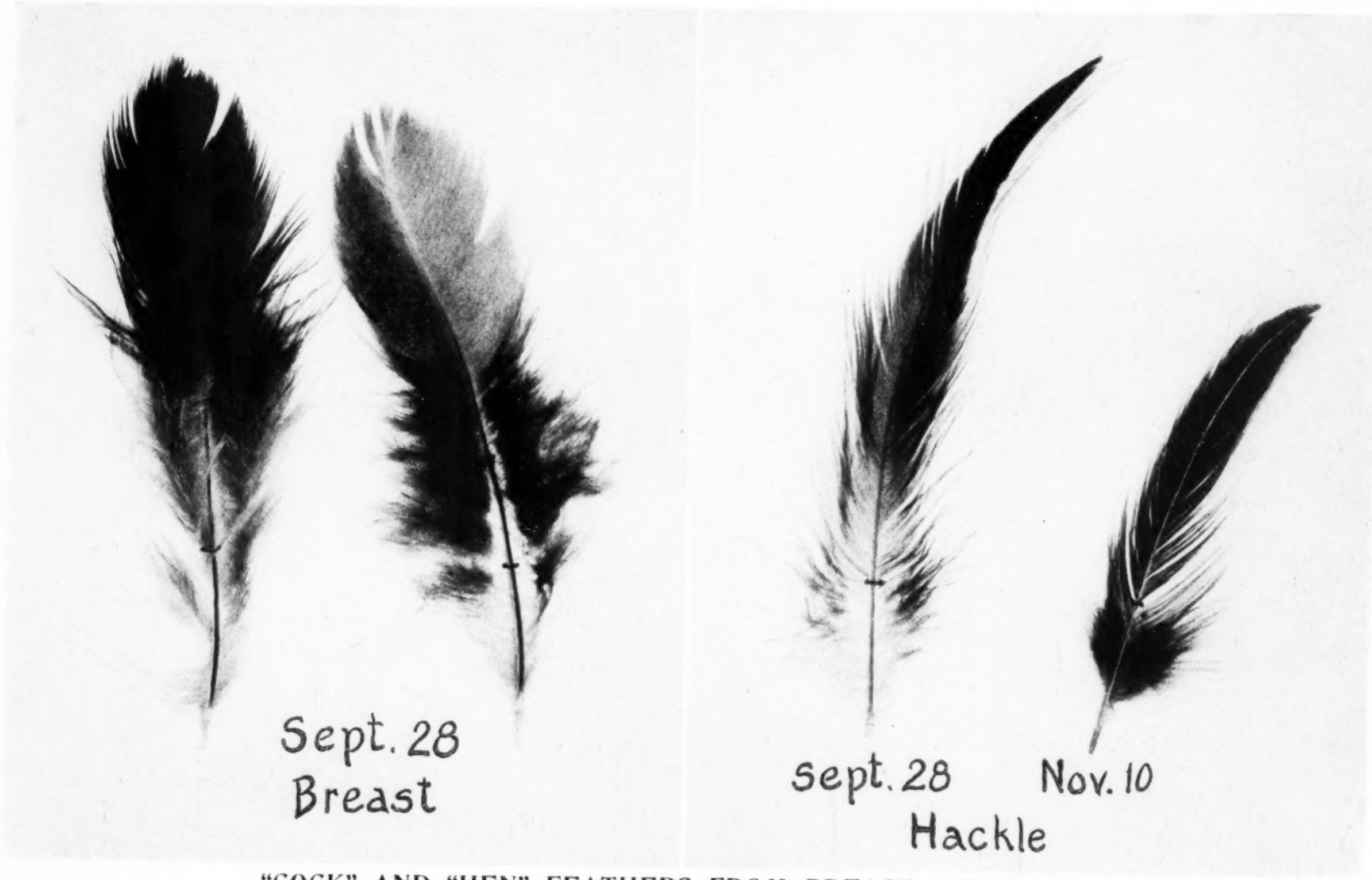
development of structures which not only resemble tests externally, but on sectioning show a testicular histological picture as well. On the left side there may result an ovo-testis, depending on whether ovarian structure is all destroyed or not, while on the right a testis may develop. In cases accompanying ovarian tumor the seminiferous tubules have been found by Boring and Pearl to contain mature spermatozoa, while Crew[4] has described a case in which a bird that had previously produced eggs so far became a male in function as actually to fertilize the eggs of a normal hen and become the father of chicks. This case, then, if substantiated, constitutes an instance of complete reversal of the sex function. Birds having both ovarian and testicular structures at the same time are in a sense hermaphrodites, though none has been reported which functioned fully and simultaneously as male and female. The nearest approach to this would appear to be the case reported by Hartman and Hamilton[12].

In ovariotomized females there may also be a subsequent development of testis-like organs and according to Benoit[1] these may even contain spermatozoa.

With this background of facts it was possible to form not only a reasonable explanation of our "rooster," but to devise means of testing the probable correctness of the assumptions. It will be noted that in all the cases mentioned above the change is in the direction of progressive maleness. The reverse process, that is, change of male fowls toward females, is certainly very rare, if indeed it ever occurs at all in Nature.* Thyroid administration (Cole[3]) may produce the assumption of hen-like feathers in the male, it is true, but no tendency for the testes to assume ovarian characteristics has been described. Female characteristics may also be induced in the male by castration followed by ovarian transplantation (Goodale[10, 11]).

The early individual history of our bird was unknown, but it seemed most

*Milojevic[14] describes a specimen which may have been of this sort.



"COCK" AND "HEN" FEATHERS FROM BREAST AND HACKLE

Figure 3

The "Cock" feathers are on the left in each case. The "Cock" breast feather was plucked on February 17—the accompanying "hen" feather replaced a "cock" feather that was pulled on the same date. The "cock" hackle feather was removed in September, and the " hen" feather was plucked after the fall molt—when the bird had returned to her normal plumage.

THE TWO STYLES OF WING FEATHERS

Figure 4

In natural colors the contrast is much more striking, the red of the cock feather having been replaced by the stippling of the female plumage. The "hen" secondary wing feather (right) was pulled on September 28, having replaced a "cock" feather removed earlier.

was removed in September, and the "hen" feather was plucked after the fall molt—when the bird had returned to her normal plumage.

logical to assume that it was really a female in which ovarian disturbance of some sort had interfered with the normal secretion of hormones by that organ. As a consequence male plumage had been assumed at the last molt, presumably the preceding fall. So far the course of events would be that of an ordinary pullet affected, say, with ovarian tumor. But now it is necessary to assume the unusual—that instead of continuing the ordinary course of ovarian tumor, whatever was disturbing the normal functioning of the ovary ceased and it again became an active egg-producing organ while the bird still retained the cock plumage assumed during its period of quiescence. One fact that seemed to lend credence to this explanation was the occurrence at the time the bird was received of occasional hen feathers, particularly on the breast, which, from their worn and faded condition, gave evidence of belonging to the previous molt, thus indicating that the assumption of the male plumage had been comparatively recent. Since the ovary was now again functioning normally in that it was producing ova, it was to be assumed that it was also secreting its normal hormones. Consequently the bird's dress was at this time out of harmony with its physiology. In such case, if feathers were pulled they should be replaced by others characteristically female in type. Furthermore, it followed that if the ovary remained normal the bird should at her next molt abandon her masquerade and resume the garb appropriate to her sex. The first test could be made at once; the second must await the normal molt in the fall.

In order to make the test, a small bunch of feathers from the hackle and another from the saddle of the right side were pulled out on February 17, 1922, and at the same time the long right sickle feather was plucked from the tail. These feathers were soon replaced by others distinctly of the female type, and when the bird finally underwent her complete molt in the fall she came out, as predicted, a normal, respectable hen, showing no evidence of her lapse from femininity (Figure 2, Photograph taken November 11, 1922).

In Figures 3 and 4 are shown pairs of feathers from the same regions, the "cock" feather in each case at the left and the "hen" feather at the right. Some of the latter are those which replaced the ones which were pulled out, while the others are from the fall molt. In both cases they are normal hen feathers. The photographs show distinctly the differences between these and the cock feathers in form and markings, but the contrast is, of course, much more striking when the different coloration is seen as well, the red of the cock feathers being replaced in general by brown and black stippling.

Only one more chapter in the history of this bird remains to be told. During the spring of 1922, while masquerading in the cock plumage, she was mated to an ordinary single comb White Leghorn male. Her behavior, in spite of her appearance, was that of a normal female; fertile eggs were obtained and a number of chicks raised.* These chickens were all white with some dark markings, as was to be expected from dominant white of the Leghorn parent; with respect to comb, however, some were rose and some single, which showed the mother to have been heterozygous for rose comb. The mystery of her unusual appearance and behavior seemed now to have been fairly explained; she appeared to have returned to the normal humdrum existence of an ordinary hen; and consequently her history was not followed further.

Summary

This modern instance of a "cock that laid eggs" may be briefly summarized.

*The fact that this bird, in spite of her resemblance to a cock, was recognized as a hen by a normal cock bird, emphasizes how much more important behavior reactions are than color in relation to mating. Such evidence would seem to minimize the effects of "sexual selection" in producing the color differences in the sexes so characteristic of many birds.

A bird with the characteristic plumage of a Brown Leghorn male, but with feminine shape of head and body, was ascertained without doubt to be laying normal eggs. The bird was mated to a white Leghorn male and a number of chicks raised. Since it was known that hens may rather frequently, as a result of ovarian disturbance, acquire male plumage, it was assumed that this was probably a case of that sort, and that subsequently, before another molt, the ovary again became functional. Such a return to normal, while probably much less common than a progressive course of the disease, would serve to explain the references in ancient and mediæval times to "cocks' eggs." It has been assumed by Evans that the "cock" condemned at Basel to be burned at the stake for this offense was not guilty,—that the eggs were in fact produced by some other bird and attributed to the "cock" as a result of over-active imagination and superstition. The facts in the case probably are that the condemned bird had actually laid the eggs, but that its guilt lay in looking like a cock when it was in reality a hen.

In the present instance this matter was tested by pulling some of the male feathers from the bird for immediate replacement and by awaiting the normal molt in the fall. As to be expected on the assumption made, the new feathers in both instances were typical hen feathers. That the bird was originally a female and that its normal hormone-producing function had been inactive for a time remains, of course, an assumption, but the most probable one. There is no evidence, furthermore, as to what may have been the cause of the ovarian inactivation, nor why the normal functional activity was recovered. In any event, it must be concluded that such recovery is relatively rare or egg-laying "cocks" would be reported much more frequently than they are.

[Note.—In a recent paper Parkes and Brambell[16] describe a hen which assumed male plumage and subsequently laid eggs, mated and produced chicks. This differs from our case in that the following year the bird molted into cock plumage again, developed male behavior and ceased laying, but resumed laying later in the fall. When it was killed and dissected all the organs appeared normal except for an enlarged spleen. It would appear that in this case there was a cyclic change in hormone production by the ovary.

Four other birds described show various degrees of assumption of male characters, in one case an ovotestis being formed on the left side.

The paper also contains a theoretical discussion and references to recent literature.]

Literature Cited

1. Benoit, J. Sur la structure histologique d'un organe de nature testiculaire dévelopée spontanément chez une poule ovariotomisée. *Compt. rend. des seances de l'Acad. des Sci.* 177:1243-1246. 1923.

2. Boring, Alice M., and Pearl, Raymond. Sex studies. XI. Hermaphrodite birds. *Journ. Exper. Zool.* 25:1-30, pls. 1-9. 1918.

3. Cole, L. J. The effect of feeding thyroid on the plumage of the fowl. *Journ. Agr. Research* 29:285-287, pl. 1 (colored). 1924.

4. Crew, F. A. E. Studies in intersexuality. Part II.—Sex-reversal in the fowl. *Proc. Roy. Soc. B.* 95:256-278, pls. 16, 17. 1923.

5. Dent, O. F. [Hermaphrodite fowl.] *Reliable Poultry Journal* 24:335. 1917. [A letter to the editor, accompanied by a photograph of the bird in question, which shows a head like a cock but a body much like a hen.]

6. Domm, L. V. Sex-reversal following ovariotomy in the fowl. *Proc. Soc. Exper. Biol. and Med.* 22:28-35. 1924.

7. Evans, E. P. The criminal prosecution and capital punishment of animals. London: x + 384 pp. 1906.

8. Finlay, G. F. Studies on sex differentiation in fowls. *British Journ. Exper. Biol.* 2:439-468, 6 pls. 1925.

9. Goodale, H. D. Gonadectomy in relation to the secondary sexual characters of some domestic birds. *Carnegie Inst. Wash.* Publ. No. 243, 52 pp., pls. 1-6 colored, pl. 7. 1916.

10. ————. A feminized cockerel. *Journ. Exper. Zool.* 20:421-428. 1916.

11. ————. Feminized male birds. *Genetics*, 3:276-299. 1918.

12. Hartman, C. G. and Hamilton, W. F. A case of true hermaphroditism in the fowl with remarks upon secondary sex characters. *Journ. Exper. Zool.* 36:185-200, 2 pls. 1922.

13. Hyde, W. W. The prosecution and punishment of animals and lifeless things in the Middle Ages and modern times. *Univ. of Penna. Law Review and Amer. Law Register.* 64:696-730. 1916.

14. Milojevic, B. D. Sur les altérations des caractères sexuels secondaires chez un coq tuberculeux. *Compt. rend. Soc. Biol.* [*Paris*] 85: 89-91. 1921.

15. Parhon, C. J., and Parhon, Constance. A pseudohermaphroditic cock. *Endocrinology.* 6:383-386. 1922.

16. Parkes, A. S., and F. W. Rogers Brambell. The anomalous appearance of male sexual characters in female fowls. *Journal of Genetics* 17:69-76, pls. 7-9. 1926.

Origin of Ability

The Families Whence High Intelligence Springs, *by* Grace Allen. Eugenics Record Office Bull. 25. Pp. 39. Cold Spring Harbor, L. I., May, 1926.

Miss Allen studied 48 families, each of whom had produced a particularly bright child. The age of the latter ranged from 3 to 10 years; their IQ's from 133 to 190 (median 156). Only one of the families belongs to the old American stock on both sides; 70 per cent. of them are Jewish. Of the fathers, 95 per cent. were in clerical, semi-intellectual, or (70%) professional work. The mental traits of all the near relatives were studied; only one of the sibs tested below IQ 100; the mean was 127. A great deal of similar information of much interest is presented, and offers a valuable comparison with L. M. Terman's study of California children. Eugenically, the most significant fact brought out here is that when these families are completed, they will not average much more than 2½ children each. In other words, these valuable strains, which occur with great rarity and might be perpetuated almost indefinitely, actually die out within a few generations because of Birth Control.

P. P.

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VARIATION IN WHORL OF THE HEAD HAIR

C. E. LAUTERBACH and J. B. KNIGHT*
Harvard University, The Graduate School of Education

ESCHRICHT[3] made a study of the direction of the hair on the human body in 1837. He says (p. 49), "From the crown the (hair) always comes forth in a whorl, and it extends fairly symmetrically in rays in all directions. In rare cases there are two crowns; I have, however, seen no example of this during the present investigation. The whorl of the crown is as a rule directed to the right, and its principal stream falls on the left side of the head."†

Voigt[12] made a similar study in 1856. In 1903 Kidd published an account of the direction of the hair in animals and man and in discussing the head hair of man says[6] (p. 76), "First, over the posterior fontanelle the familiar whorl or 'crown' is always present and may lie to the right or left of the middle line, seldom quite in the middle line, and it is double in a certain number of persons, one whorl lying on each side of the middle line."

Sano[10] has called attention to a case of reversal in direction of the crown in a pair of identical twins, and Newman[8] has referred to this condition as symmetry reversal. Brewster[1] in 1925 reported a study of heredity in whorl of the head hair, the crowns in this case being double and presumably whorling in the same direction.

In 1925, Lauterbach[7] reported the results of a study of 212 pairs of twins. It was discovered that 24.2 percent of all twin *pairs* (13.7 percent of all individual twins) showed some variation from the usual clockwise whorl. It was further discovered that this variation was not always in the form of a counter-clockwise whorl, but frequently assumed the form of double whorls which might combine in a number of ways.

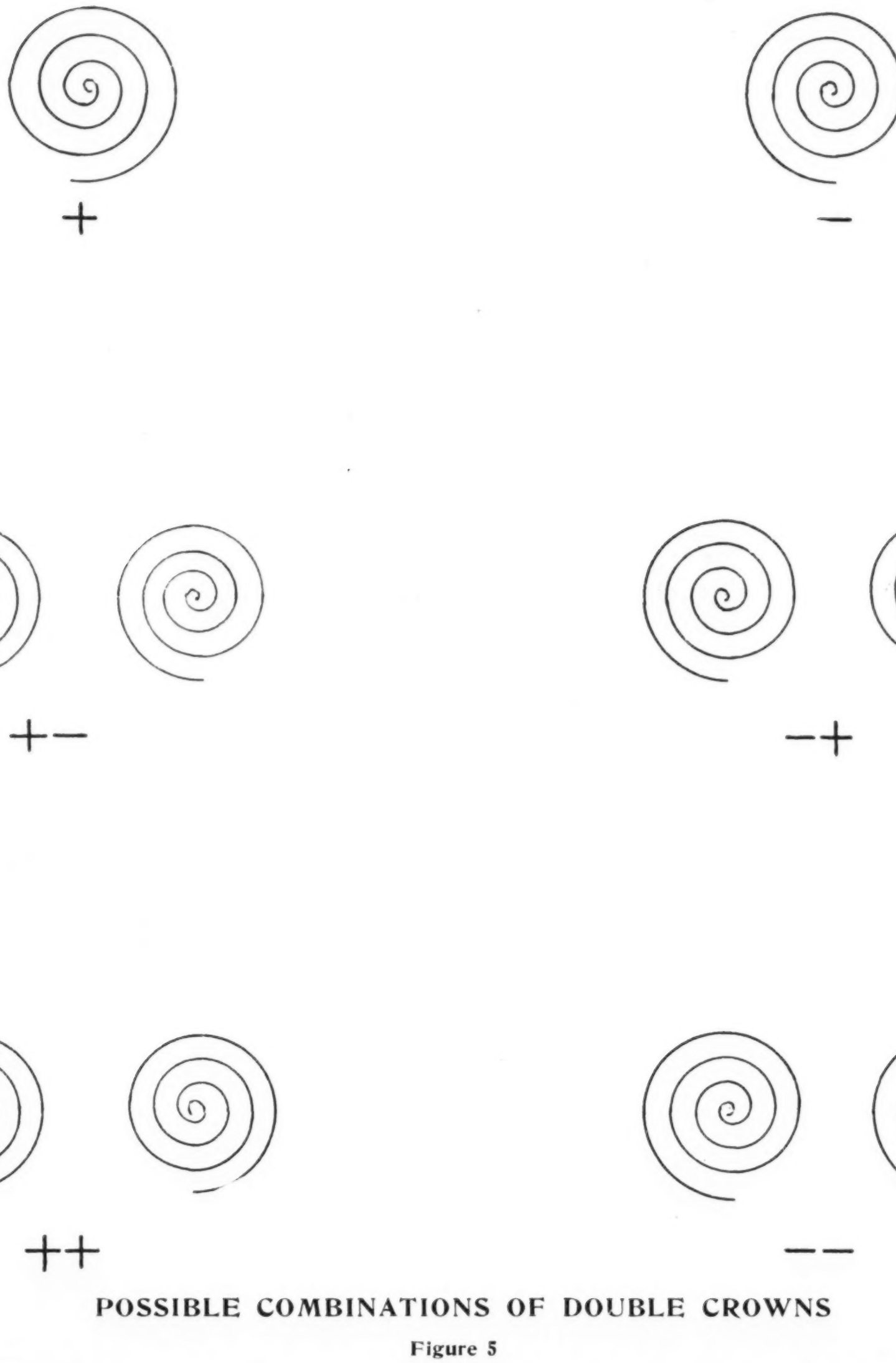
An extensive literature on the hair, mostly medical, has been developed. Friedenthal[4] reports a bibliography of 1270 books and papers, presumably complete to that date (1908). But little reference, however, seems to have been made to variation in the whorl of the head hair or the frequency of its occurrence. The large percentage of variation in the whorls of twins suggested the possibility that this might be a phenomenon characteristic of twinning. There was a frequent coincidence, also, of left-handedness and left whorls. It seemed desirable, therefore, to find out what the variation in a random sampling of the population is.

With this purpose in view, the heads of 1003 children in the schools of Watertown, Massachusetts, ranging in age from 6 to 15 years, were examined. An attempt was made to group them according to nationality, thinking that such a grouping might afford some clue to racial differences if any exist. In this grouping the term "American" is used for convenience to include children of English extraction whose nationality could not be more accurately determined. No individuals of the black or yellow races are included.

In the report which follows, Lauterbach's[7] method of designating whorls is used. A plus sign (+) indicates a whorl to the right, or clockwise; a minus sign (—), a whorl to the left, or counter-clockwise. Two signs

*Originally received for publication April 26, 1926.

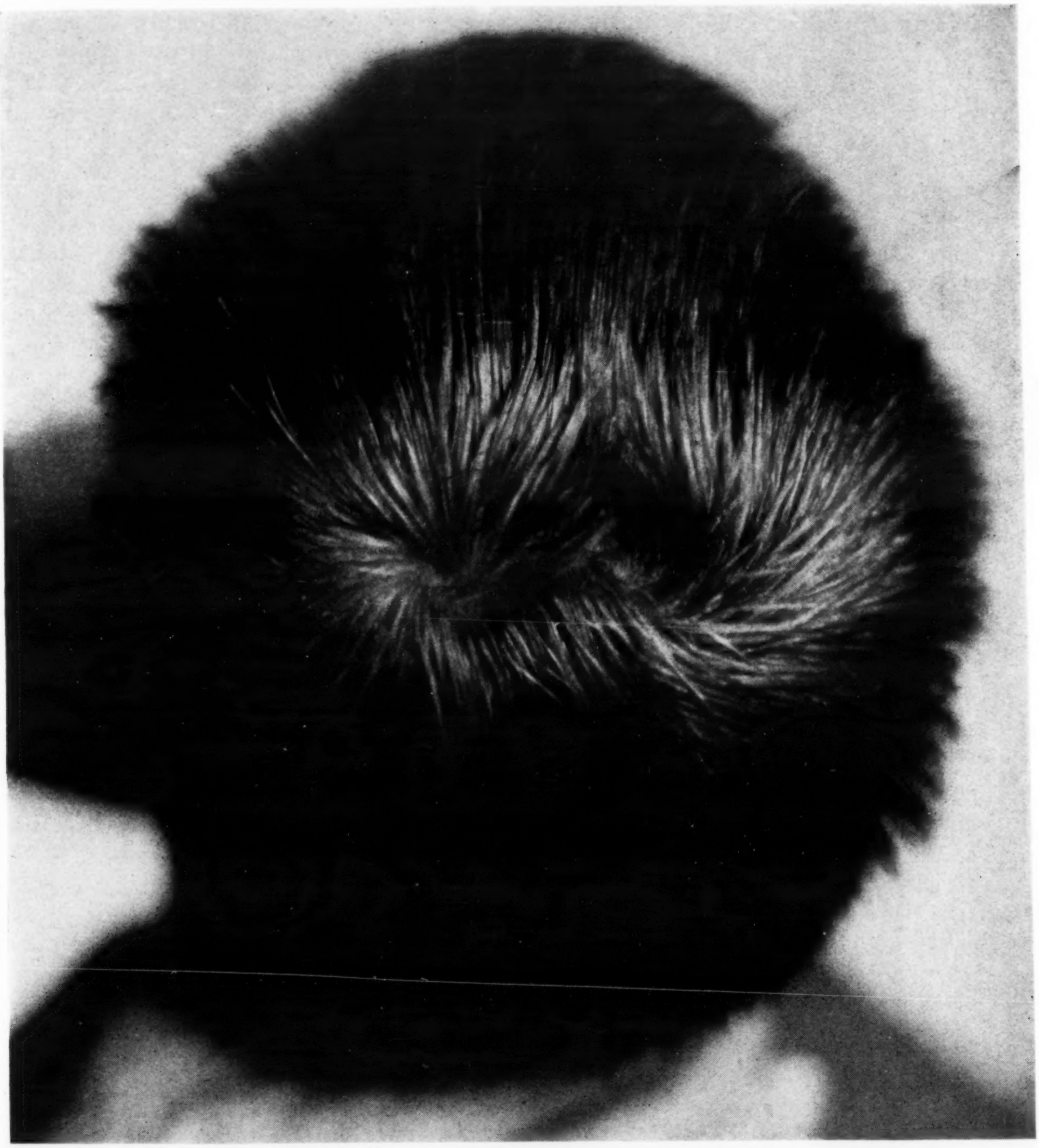
†"Von dem Scheitel fängt die Ausströmung immer mit einem Wirbel an, und erstreckt sich ziemlich gleichmässig in Strahlen nach allen Richtungen. In seltenen Fällen giebt es zwei Scheitelwirbel; ich habe aber hiervon kein Beispiel während dieser Untersuchung vor Augen gehabt. Der Scheitelwirbel ist in der Regel rechts gedreht, und seine Hauptströmung fällt auf die linke Siete des Kopfs."



POSSIBLE COMBINATIONS OF DOUBLE CROWNS

Figure 5

Showing the possible variations and combinations of single and double crowns.



A RARE FORM OF DOUBLE CROWN

Figure 6

Both whorls are counter-clockwise (— —), the only combination of this kind found on 1854 heads.

in a parenthesis indicate a double crown, and the position of the signs indicates the relative position of the whorls on the head. The possible combinations on a single head are sketched in Figure 5. One other condition has been observed, and that is a combination of more than two whorls, or *polywhorls*. Several cases of three whorls have been recorded, and one case of four.

From Table I may be derived the fact that 23.4 percent of the population have whorls which vary from the single clockwise condition. Eighteen and one-tenth percent have negative whorls; 4.9 percent have double whorls; and almost one-half of one percent have polywhorls.

The percentage of variation among right-handed individuals is 23.7 percent; among left-handed individuals, 20.0 percent. There is, therefore, apparently no correlation between handedness and variation in whorl of the head hair. There is an element of error in this result, however, due to the method of determining handedness. The children were asked to throw a ball or to indicate the hand in which a spoon was held while eating, or a needle, while sewing. The total amount of left-handedness in the group as determined by this method is 7.5 percent. This figure is almost twice that reported by Jones[5] but only about a fourth of that reported by Parsons.[9]

The amount of variation in whorl

TABLE I

SHOWING WHORL OF THE HEAD HAIR OF 1003 NORMAL CHILDREN GROUPED ACCORDING TO SEX AND HANDEDNESS

SEX	HANDEDNESS	Single Whorl		Double Whorl				Polywhorl	Total	Recapitulation	
		+	-	+-	-+	++	--			Double Whorl	Total Variation
Male	+	354	88	24	4	5		2	477	33	123
Male	-	36	7	1				1	45	1	9
Total		390	95	25	4	5		3	522	34	132
Female	+	354	81	12		3		1	451	15	97
Female	-	24	6						30		6
Total		378	87	12		3		1	481	15	103

TABLE II

SHOWING WHORL OF THE HEAD HAIR OF 851 FEEBLE MINDED INDIVIDUALS

CLASS	Single Whorl		Double Whorl				Polywhorl	Total	Recapitulation	
	+	-	+-	-+	++	--			Double Whorl	Total Variation
Idiots	159	45	17	7	2	1	2	233	27	74
Imbeciles	212	51	8	3	3		1	278	14	66
Morons	255	70	10	2	3			340	15	85
Total	626	166	35	12	8	1	3	851	56	225

of the head hair among the males is 25.3; among the females, 21.4 percent. The greater variability of the male is, therefore, once again demonstrated.

Among the Armenians the variation is 27.3 percent; among the Irish it is 20.8 percent; among the Italians, 24.0 percent. These are the only groups (except the "American," which probably has little if any significance) large enough to afford results approaching reliability. The percentages do not vary markedly from the 23.4 percent established for the population as a whole. (See Table III.)

The number of families with twinning histories, forty-two, and the actual number of twins, seventeen, is too small to yield reliable results. It may be noted, however, that the percentage of variation is somewhat larger for both of these groups than for the normal group. (See Table IV.)

Because of the occassional coincidence of variation in whorl of the head hair with low intelligence quotients, the heads of a group of feebleminded individuals were examined. This investigation was made possible through the cooperation of Dr. R. A. Greene and his assistants at the Walter E. Fernald State School for the Feeble Minded, at Waverly, Massachusetts. The group included 457 males and 394 females ranging in age from 9 to 50 years. Three classifications, idiots, imbeciles, and morons, based on intelligence quotients, were made. (See Tables III and IV.)

Each of these groups was subdivided into three types, type 1, germ plasm; type 2, accidental; and type 3, unknown. The germ plasm type includes those individuals whose feeblemindedness is hereditary as determined by family history (Tredgold's "intrinsic" type). The accidental type includes those whose feeblemindedness is due to environmental influences like disease or other "accident" (Tredgold's "extrinsic" type). The "unknown" type includes all subjects, the cause of whose defect is uncertain or unknown.

Table II reveals a variation in the whorl of the head hair of the feebleminded of 26.4 percent. The variation in the whole population was established at 23.4 percent (Table I). While the variation among the feebleminded is, therefore, greater than the "normal" group, it is apparently not significantly so.

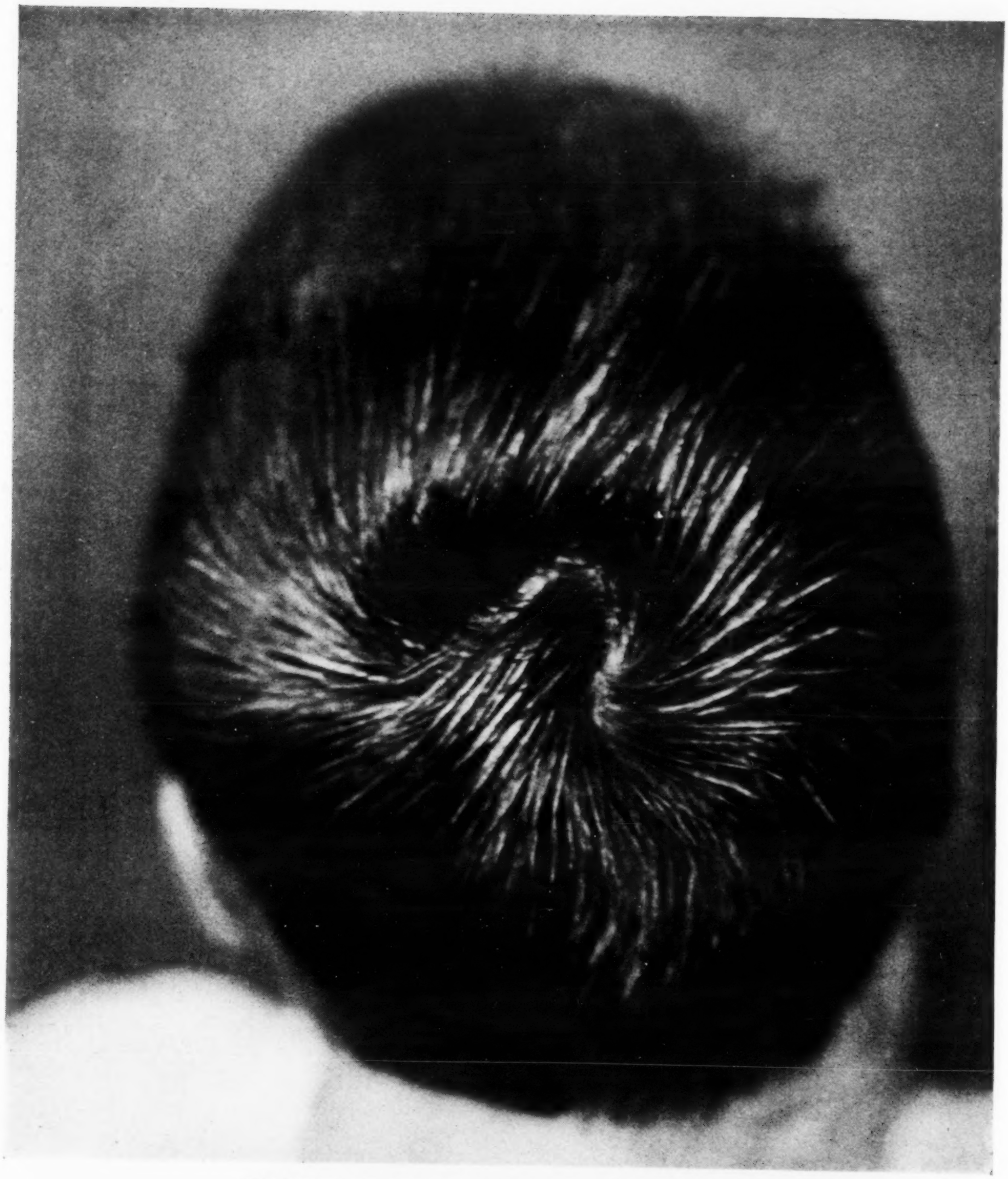
The variation among the idiot group, however, is 31.8 percent, higher than for either the imbeciles or the morons, and considerably higher than the normal group.

When the 851 cases are divided according to sex and type, we find the variation for the males to be 28.4 percent; for the female, 24.1 per cent. The variation among the female idiots runs up to 28.1 percent; among the male idiots, to 34.0 percent. Variation is greatest in the idiot group, particularly among the *males*. (Tables IV and V.)

It should be noted that variation among the feebleminded is greater than among the normal group in all traits. This is true of stature, of weight, or deformities of the ears, asymmetry of the head, etc. Church and Peterson[2] (p. 715) for example, record reported abnormalities of the palate ranging from 43 to 82 percent. A variation of 34 percent in whorl of the head hair is therefore not conspicuously high for the idiot group.

The correlation between variation and type is not convincingly high. It may be noted that where percentage comparisions are possible between types 1 and 2, type 1 shows a greater variation in 13 out of 22 instances. A comparison with type 3 would not be valid, since the "unknown" group is composed of subjects from both type 1 and 2.

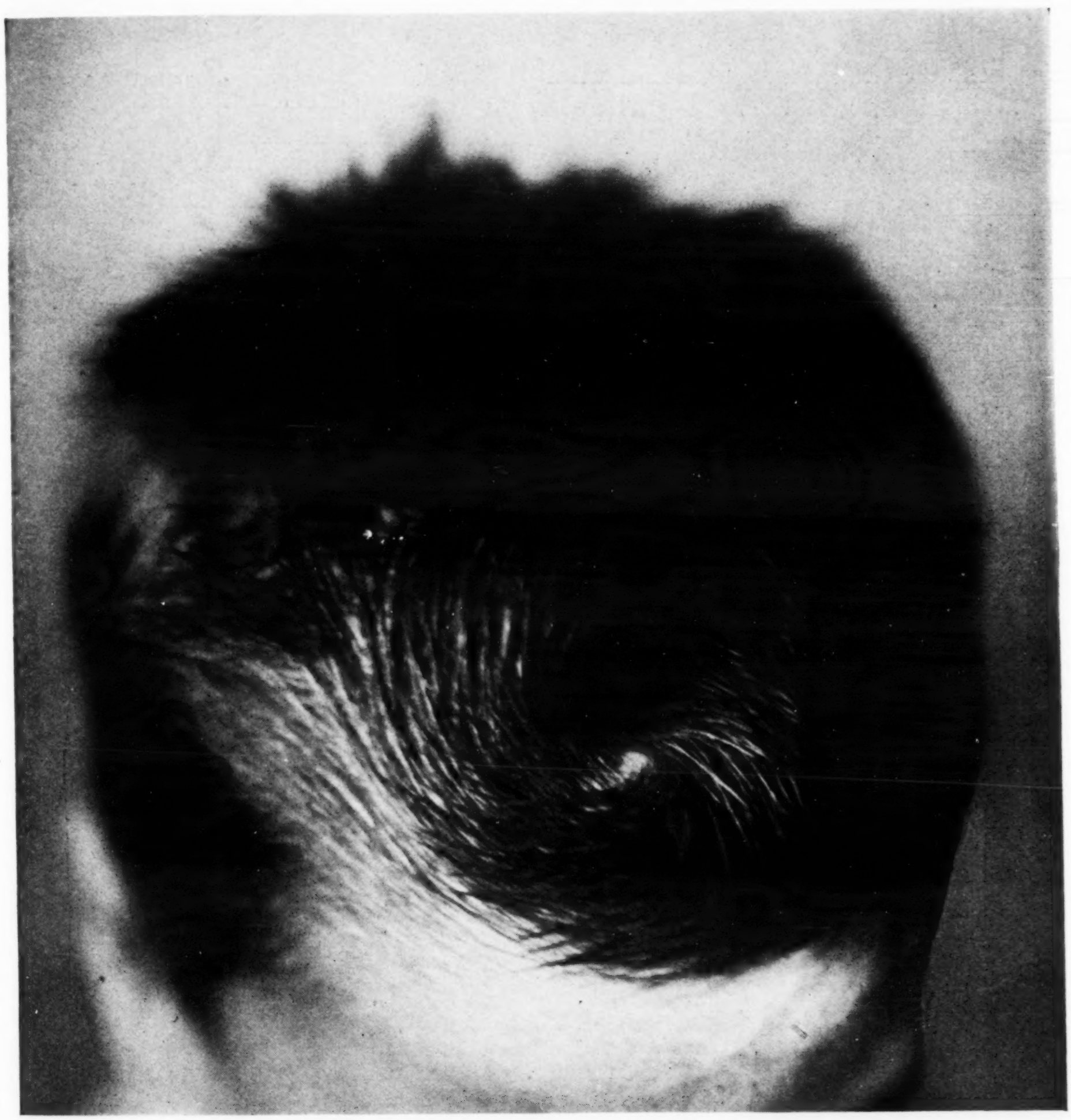
It will be observed that the most frequent variation is a single whorl to the left. Among the normal group this variation is 18.1 percent (Table I); among the feebleminded, 19.5 percent (Table II). Of double whorls the plus-minus (+ —) combination is most frequent. It is interesting to note that among the 1854 heads ex-



THREE CROWNS ON A SINGLE HEAD

Figure 7

In addition to a double crown in the occipital region, this boy had one just above his forehead, as is shown in Figure 8.



A "CROWN" ON THE FOREHEAD

Figure 8

This "much crowned" individual also has two crowns in the normal position. This one is a perfect whirlpool which cannot be disturbed in the least by combing.

TABLE III

SHOWING HANDEDNESS AND WHORL OF THE HEAD HAIR OF 1003 NORMAL CHILDREN GROUPED ACCORDING TO NATIONALITY

NATIONALITY	Right-handed	Left-handed	Total	Positive Whorl	Negative Whorl	Double Whorl	Polywhorl	Total Variation
	Frequency Distribution							
American	312	35	347	271	61	13	2	76
Armenian	126	13	139	101	29	9		38
French	15	1	16	13	2	1		3
Greek	13	2	15	9	5	1		6
Irish	111	9	120	95	19	6		25
Italian	251	11	262	199	47	14	2	63
Slav	15		15	15				
Scandinavian	10	1	11	6	4	1		5
Scotch	25		25	20	5			5
Others	50	3	53	39	10	4		14
Total	928	75	1003	768	182	49	4	235
	Percentage Distribution							
American	90.0	10.0	100.0	78.1	17.6	3.7	0.6	21.9
Armenian	90.6	9.4	100.0	72.7	20.9	6.4		27.3
French	93.8	6.2	100.0	81.3	12.5	6.2		18.7
Greek	86.7	13.3	100.0	60.0	33.3	6.7		40.0
Irish	92.5	7.5	100.0	79.2	15.8	5.0		20.8
Italian	95.8	4.2	100.0	76.0	17.9	5.3	0.3	24.0
Slav	100.0		100.0	100.0				0.0
Scandanavian	90.9	9.1	100.0	54.5	36.4	9.1		45.5
Scotch	100.0		100.0	80.0	20.0			20.0
Others	94.3	5.7	100.0	73.6	18.9	7.5		26.4
Total	92.5	7.5	100.0	76.6	18.1	4.9	0.4	23.4

TABLE IV

SHOWING WHORL OF THE HEAD HAIR AND HANDEDNESS IN RELATION TO TWINNING

(A) Families With Twinning Histories

GROUP	Right-handed	Left-handed	Total	Positive Whorl	Negative Whorl	Double Whorl	Polywhorl	Total Variation
	Frequency Distribution							
Twinning Families	36	6	42	31	6	4	1	11
Non-Twinning Families	891	70	961	737	176	48		224
Total	927	76	1003	768	182	52	1	235
	Percentage Distribution							
Twinning Families	85.7	14.3	100.0	73.8	14.3	9.5	2.4	26.2
Non-Twinning Families	92.7	7.3	100.0	76.7	18.3	5.0		23.3
Total	92.4	7.6	100.0	76.6	18.1	5.2	0.1	23.4

(B) Actual Twins

Frequency	17	17	12	3	1	1	5
Percentage	100.0	100.0	70.6	17.6	5.9	5.9	29.4

TABLE V

SHOWING WHORL OF THE HEAD HAIR OF 394 FEEBLE MINDED FEMALES

CLASS	TYPE	Single Whorl -	Double Whorl -+	Double Whorl ++	Polywhorl	Total	Recapitulation: Double Whorl	Recapitulation: Total Variation
		Frequency Distribution						
Idiot	1	22	9	2		33	11	
	2	32	8			41	9	
	3	10	4	1		15	5	
	Total	64	21	4	89			25
Imbecile	1	48	14	4	1	67	19	
	2	43	10	1		54	11	
	3	33	5	1	1	39	6	
	Total	124	29	6	140			36
Moron	1	63	16	2		81	18	
	2	18	7			25	7	
	3	30	8	1		39	9	
	Total	111	31	3	145	364	34	95
TOTAL		299	81	13	1	364	34	95
		Percentage Distribution						
Idiot	1	66.7	27.3	6.0		100.0	33.3	
	2	78.1	19.5	2.4		100.0	22.0	
	3	66.7	26.7	6.6		100.0	33.3	
	Total	71.9	23.6	4.5	100.0			28.1
Imbecile	1	71.6	20.9	6.0	1.5	100.0	28.4	
	2	79.6	18.5	1.9		100.0	20.4	
	3	84.6	12.8	2.6		100.0	15.4	
	Total	77.5	18.1	3.8	0.6	100.0		22.5
Moron	1	77.8	19.8	2.4		100.0	22.2	
	2	72.0	28.0			100.0	28.0	
	3	76.9	20.5	2.6		100.0	23.1	
	Total	76.6	21.3	2.1	0.3	100.0	3.3	23.4
TOTAL		75.9	20.5	3.3	0.3	100.0		24.1

TABLE VI

SHOWING WHORL OF THE HEAD HAIR OF 457 FEEBLE MINDED MALES

CLASS	TYPE	Single Whorl -	Double Whorl -+	Double Whorl ++	Polywhorl	Total	Recapitulation: Double Whorl	Recapitulation: Total Variation
		Frequency Distribution						
Idiot	1	40	8	2	1	58	9	
	2	39	13	2	1	61	9	
	3	16	3	1		25	5	
	Total	95	24	5	144		23	49
Imbecile	1	27	6	1		34	1	
	2	26	5	2	1	34	3	
	3	35	11	3	1	50	4	
	Total	88	22	6	2	118	8	30
Moron	1	57	16	5	2	80	7	
	2	11	2	1		14	1	
	3	76	21	3	1	101	4	
	Total	144	39	9	3	195	12	51
TOTAL		327	85	20	5	457	43	130
		Percentage Distribution						
Idiot	1	69.0	13.8	3.4	1.7	100.0	15.5	
	2	63.9	21.3	3.3	1.6	100.0	14.8	
	3	64.0	12.0	4.0		100.0	20.0	
	Total	65.9	16.7	3.5	1.4	100.0		31.0
Imbecile	1	79.5	17.6	2.9		100.0	20.6	
	2	76.5	14.7	5.9	2.9	100.0	17.6	
	3	70.0	22.0	2.0	4.0	100.0	30.0	
	Total	74.6	18.7	3.9	2.8	100.0		25.4
Moron	1	71.3	20.0	6.3	2.5	100.0	8.8	
	2	78.6	14.3	7.1		100.0	21.4	
	3	75.2	20.8	4.0		100.0	24.8	
	Total	73.9	20.0	4.1	2.0	100.0		26.2
TOTAL		71.5	18.6	5.3	2.2	100.0		28.4

amined, only one minus-minus (— —) combination was found. Polywhorls appear infrequently. The combinations observed are (+ — +), four cases; (+ + —), one case; (— — +), one case; (+ — + —), one case.

These whorls are located usually in the parietal region on a line with the saggital suture, slightly anterior to the posterior superior angle. They may, however, assume any position on the scalp within the area covered by the head hair. Perfect whorls have been observed below the occipital protuberance, as well as in the very edge of the hair on the forehead. Double whorls may lie very close together, so close in fact that one whorl merges with the other; or they may assume positions on entirely different parts of the head. In the case of polywhorls, two whorls may be closely associated, while the third assumes a distant position. (See Tables V and VI.)

Hair streams appear in a variety of forms on the scalp. Kidd[6] gives sketches of eight variations in the frontal region of young human subjects. Irregularities in these streams tend to form "cowlicks," which sometimes suggest incomplete whorls.

Determination of the direction of the whorl of the head hair is not difficult except in occasional instances in which the hair is very long or very curly or has entirely disappeared. In this investigation forty cases were left undetermined for such reasons. Frequently observation is all that is necessary, but a sterilized comb facilitates examination. The criminal and insane classes offer an opportunity for further study which may yield interesting results.

1. Brewster, E. T., 1925. The Inheritance of "Double Crown." *Journal of Heredity* 16: 345-346.

2. Church, A., and Peterson, F., 1908. Nervous and Mental Diseases. 945 pp. Philadelphia: W. B. Saunders Co.

3. Eschricht, D. F., 1837. Uber die Richtung der Haare am menschlichen Körper. *Müeller's Archiv für Anatomie und Physiologie.* Jahrg. 1837: 37-62.

4. Friedenthal, Hans, 1908. Das Haarkleid des Menschen. 179 pp. and 43 colored plates. Jena: Gustav Fischer.

5. Jones, W. Franklin, 1918. A Study of Handedness. 80 pp. Vermillion, S. D.: University of South Dakota.

6. Kidd, Walter, 1903. The Direction of the Hair on Animals and Man. 154 pp. London: Adam and Charles Black.

7. Lauterbach, C. E., 1925. Studies in Twin Resemblance. *Genetics* 10: 525-568.

8. Newman, H. H., 1923. The Physiology of Twinning. 230 pp. Chicago: Chicago University Press.

9. Parsons, B. S., 1924. Left-handedness. 185 pp. New York: The Macmillan Co.

10. Sano, F., 1918. A Convolutional Pattern of the Brains of Identical Twins. *Philos. Trans. Roy. Soc. London B*, 208:37-61.

11. Tredgold, A. F., 1908. Mental Deficiency. 391 pp. London: Bailliere, Tindall and Cox.

12. Voigt, C. A., 1856. Abhandlung über die Richtung der Haare am menschlichen Körper. *Denkschriften der Akademie d. Wissenschaften zu Wien*, Mathematisch-Naturwissenschaftliche Classe, Part II, 13: 1-50.

Breeding and Geography

Industrial and Commercial Geography (New Edition) *by* J. Russell Smith, pp 959, price $3.00. Henry Holt and Company, 1925.

Smith's text is widely used in collegiate schools of commerce, finance and business administration but it is worthy of wider reading. The aim has been to interpret the earth in terms of its usefulness to humanity. It is noteworthy in that much emphasis is placed on plant breeding as an important economic activity with which the business man must become familiar.

Professor Smith discusses cereals, starch foods, the animal industries, the vegetable, fruit, and wine indus-

(*Concluded on page* 142)

ABACA IN THE PHILIPPINES

Figure 9

View in a Manila hemp plantation at Davao, P. I. Manila hemp is a species of banana, and the two are very similar in appearance. Photograph courtesy of Bureau of Agriculture, Manila, P. I.

INTRODUCTION OF MANILA HEMP

P. J. WESTER

MANILA HEMP "BANANAS"

Figure 10

Photographed 47 days after picking. The seeds of manila hemp are extremely delicate and when handled in any of the usual ways they invariably die in a few days. By picking the fruits green, like bananas, it was found that the seeds matured during the long journey to America. The seeds in this fruit were removed after arrival in the United States, and the plants that germinated from them were among the first to be grown in the Western Hemisphere. Photograph by Lyster H. Dewey.

THE production of *abaká,* or Manila hemp, is a major industry in the Philippines which have a world monopoly of this, one of the most important fibers. In 1924, 485,000 hectares were planted to *abaká,* and 177,312 metric tons of Manila hemp, valued at $29,950,000 were exported, of which approximately three sevenths went to the United States.

Native of the Philippine Islands the plant of abaká, *Musa textilis,* is closely related to, and so much resembles the banana that only those familiar with them can distinguish the one from the other. The fruits look like small bananas and contain many black seeds about the size of sorghum grains. These rank among the most perishable of all seeds, and the several shipments made to this country, with one exception have never arrived in a viable condition. These seeds were packed in charcoal or other media commonly used for perishable seeds that require moist packing, but when handled in this way the seeds failed to germinate at the end of their journey. Largely for this reason *abaká* still remains a Philippine monopoly.

Recalling the close relationship between *abaká* and the banana it oc-

MANILA HEMP SEEDLINGS IN THE UNITED STATES

Figure 11

Growing at the Bell Plant Introduction Station, Glendale, Maryland—from the first abacá seed to be successfully germinated in the United States. Photograph by Paul Russell.

curred to the writer that the difficulty in successfully sending *abaká* seeds long distances might be overcome by cutting full grown but immature bunches of fruits and allowing them to ripen in transit as is done with bananas. Accordingly, when leaving Manila for San Francisco in January, 1925, I took with me in the cabin several bunches of *abaká* fruits, comprising five varieties. On arrival in San Francisco the fruits had turned yellow or black, but the seeds appeared to be in good condition. From there the fruits were sent to the Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C., where they arrived 41 days after leaving Manila, and not less than 47 days from the time they were cut from the plants. More than 100 plants were successfully raised from the seeds at the Bell Plant Introduction Garden, Glendale, Md. The seedlings show marked variation, and it is not unreasonable to hope that some may prove equal or even superior to the varieties now in existence.

Some months after these seeds were imported a shipment of plants was also successfully brought from Davao, Mindanao, to the Canal Zone by Mr. H. T. Edwards, Fiber Expert of the Bureau of Plant Industry, and in time we may expect to see hemp plantations established in the American tropics for the production of *abaká* independently of the Philippine Islands. That this should be done without delay is a matter of particular importance in view of the appearance of a disease of the Manila hemp plant in the Philippines that in combination with insect pests has virtually wiped out one *abaká* district, is making serious inroads in another, and has spread to other important hemp centers.

CONSERVING THE FAMILY

A Review of Three Books on Human Reproduction and the Family

IN his "Conservation of the Family," Popenoe treats in a number of brief and well-written chapters of a series of problems connected with human sex and family life, such as types of mating, social sanctions of marriage, celibacy and ascetic ideals, pre-marital incontinence, delayed marriage, broken homes, prostitution, illegitimacy, abortion, birth-control, excessive reproduction in inferior families, the means to social control of marriage, etc. Many of his opinions on these subjects are hardly more than commonplaces and would probably be accepted by anyone who has given them any thought.

The volume is advertised as the "first book to consider family life from the biological point of view." The author, regards the family as a biological adaptation and starts from this as a basis for his conclusions. If, however, the work purports to be a scientific contribution, even in popular form, it is hardly possible to sympathize with its author's general attitude. This is far too much like that of the typical American preacher and Philistine, who, having settled his own sexual and marital life to his own satisfaction, feels an irrepressible urge to settle that of other people. Popenoe seems to believe that preaching, legislation and hortatory and prohibitive education will somehow produce more, larger and better families. This is indicated by his language. In 254 pages the words "must" or "must not" occur 105 times, "should" or "should not" 179 times and "ought to" at least 20 times, not to mention a great number of valuative and hortatory periphrases of the same intent. This language is clearly early Victorian and out of place even in a popular scientific treatise.

It is no doubt true that the family is a biological adaptation, but it is also true that European and American society is undergoing rapid changes and that sex and family life will continue to be adaptive and may, therefore, be expected to undergo considerable modification. It is well known that throughout the animal kingdom social development always brings about great changes in the sexual behavior of the individual participants and that the more complete the social integration the more reproduction is restricted to a certain limited number of individuals. Both sexual behavior and reproduction are, therefore, repressed or altogether abolished in most of the members of the society. This condition obtains in all highly integrated societies and on all levels, from that of the Metazoan body, or soma, to that of the societies of Metazoa, from the colonial jelly-fishes to ants, bees, wasps and termites. In fact, high development seems to be incompatible with individual reproduction in even a large proportion of the members of an animal society. Human society, though at present in a diffuse and feebly integrated stage, compared with that of many animal societies, is evidently on the road to much more intensive socialization. We may naturally inquire, therefore, whether we are not moving simultaneously in two directions, first towards much greater freedom of sexual behavior without reproduction, and second towards the restriction of reproduction or family life to a relatively small number of individuals. Certainly these two tendencies have been manifested in the past by all the highest civilizations.

What we need, before we begin to apply our still very incomplete biological knowledge of sex and the family to human society, is a much more comprehensive and detailed knowledge of the

*PAUL POPENOE, Conservation of the Family. Williams and Wilkins, Baltimore, 1926. 266 pp.

actual sexual situation in civilized societies at the present time. What we actually know about this matter is, as Popenoe shows, extremely meager and unsatisfactory. Evidently a very considerable proportion of the population is over-sexed, under-sexed, intersexed or no-sexed and, therefore, not well-suited to family life of the old-fashioned, rural, or garden variety. It is, of course, very easy to tell all these people to go to hell, but many of them are so devilishly attractive and, apart from their sexual behavior, so very efficient socially, that they are constantly being married by those who are blessed with normal sexual proclivities and ideals, like Mr. Popenoe, with the sad results which he deplores in his volume. It is also extremely easy to tell all these abnormal individuals ("abnormal," of course, from ones own necessarily standard point of view) that they should, must or ought to behave normally in their own interests and those of society. But have thousands of years of preaching legislation and popular education shown any improvement in the control of emotions and activities which must have been successfully exercised by every one of the innumerable animal and human generations that are represented by surviving descendants at the present time? Certainly one must be very näive to suppose that forces, which have developed and been consolidated, so to speak, for more than half a billion years in countless generations, from the lowest Metazoa to our most intelligent Fundamentalists can be regulated and controlled by preaching at them, legislating about them and teaching children what it is nice or naughty to do in regard to them, before we know very, very much more about them. In the opinion of the reviewer, a partial preparation for writing seriously on sex and the family in the human species might advantageously include first, a careful study of Pareto's "Treatise of Sociology," for the purpose of acquiring a really scientific, nonvaluative and nonhortatory attitude towards biosociological problems; second, a perusal of some 300 of the best modern French novels, including, of course, those by Marcel Proust, André Gide, de Gourmont and Istrati, and third some years of intensive investigation of human sexual and marital behavior in a few large European capitals, preferably Paris and Berlin. One might then return and after twenty years of further intensive investigation and profound meditation on the familial and extra-familial sex life of our mongrel and benighted population, write something really worth reading.

Popenoe's "Problems of Human Reproduction"* is excellent, just because in this small book he is, except in a few paragraphs, simply biological and expository. Indeed, the tone of the work is so objective that it does not seem to have been written by the author of "The Conservation of the Family." The account of reproduction could hardly be surpassed in brevity, lucidity, accuracy and interest. The many points that have not been settled by the medical and genetic specialists are clearly emphasized and duly left open. This book can be read with profit by every man and woman.

Von Gruber's book† in the original German edition seems to have been very popular ("300,000 copies sold abroad"). Somewhat more than a third of the volume is devoted to an exposition of modern views on fertilization and heredity and the pertinent cytological evidence; the remainder treats of the organs of sex, the sexual instinct, limitation of conception, aberrations of the sexual instinct, venereal diseases and their prevention, and marriage *versus* free-love. While it is a useful book to place in the hands of the young, a biologist or person of mature mind will find it less interesting than Popenoe's "Problems of Human Reproduction."

W. M. Wheeler.

*Paul Popenoe, Problems of Human Reproduction, Williams and Wilkins, Baltimore, 1926. VIII + 218 pp.

†Max von Gruber, Hygiene of Sex, Williams and Wilkins, Baltimore. VI + 169pp.

FIVE GENERATIONS OF AN INFERIOR FAMILY

WILLIAM M. CLAY and E. MEAD WILCOX,
Transylvania College, Lexington, Ky.

THE present study of this family covers five generations, comprising a total of twenty individuals. Concerning some of these it was very difficult or impossible to get definite and complete data. The main characters noted are mentality, physical defects, morality, shiftlessness and thrift, and, in one case, criminal tendency in the extreme form of murder. This family is not one in which an extremely large number of anti-social tendencies are found, but a sufficiently large number are present to justify a study of those individuals. Fortunately, the marriage and birth rate among them is not as great as it is in many families of this type; yet the total number of offspring of each generation is not decreasing but rather there is a tendency towards an increase. The number of males studied is about equal to that of the females, the ratio being nine to eleven.

As far as known, this family is confined to central Kentucky. Their shiftlessness makes them so undesirable that they seldom remain in one "home" very long but are almost constantly on the move from one community to another. Four of them were found to have spent a period or periods in almshouses and practically all are more or less dependent upon charity and the "county" for their support. They dwell in rural communities or small towns, in miserable old hovels of whatever kind is available to them.

The first one of which we have any record, I-1, was at one time the owner of a small farm, but before his death he was living in poverty. His ownership of a farm can be accounted for by the fact that at that time (about the beginning of the nineteenth century) land could be obtained at little or no expense. At any rate, the fact that before his death he had become a pauper

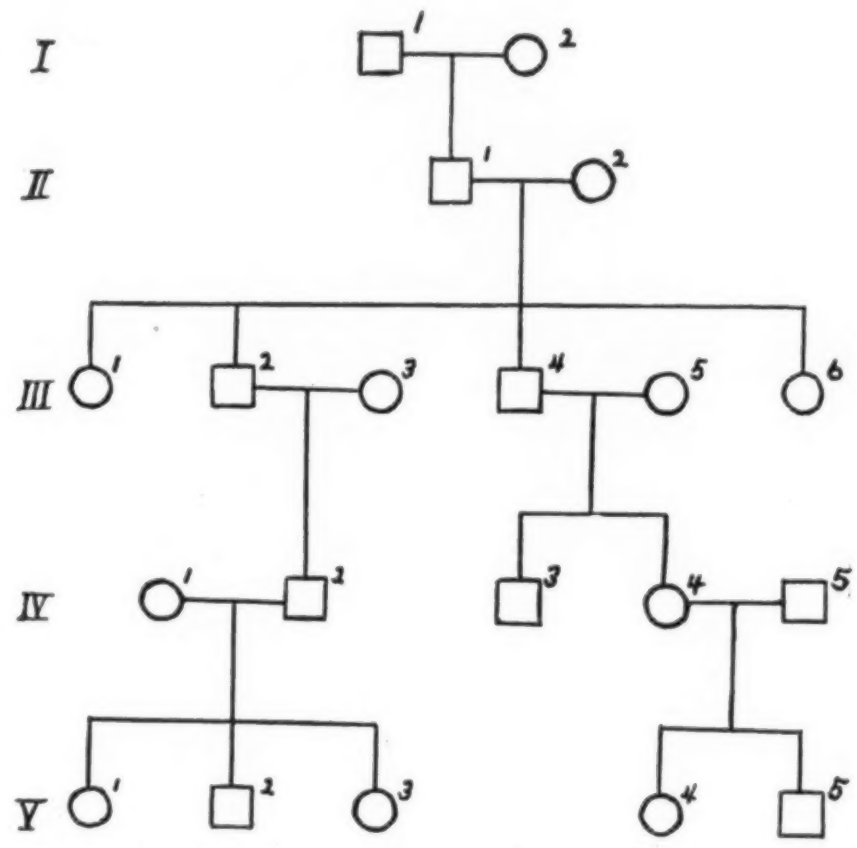


Figure 12

strongly indicates that he was of low mentality and inclined to shiftlessness. Whence he migrated from could not be learned, but it seems that he was the first one of this clan to settle in Kentucky. About his wife nothing was learned.

Their son, II-1, due to a certain peculiarity, is an interesting character. It seems that he boasted frequently that he had never taken a bath nor a dose of any kind of medicine during his lifetime; yet he lived to be nearly ninety years of age. He was of very low intelligence, illiterate, and lived a life of pauperism. Although he was inclined to idleness to a certain extent, he was not what one would call a vagabond, and it does not seem that he possessed criminal traits in a very marked degree. About his wife, II-2, nothing was learned except that she lived to an old age.

One of the best known individuals of the clan is III-4, as he is still living and information about him was readily obtainable. He is a low-grade moron, illiterate, and lives in poverty. He is notorious as a liar, preferring, it ap-

ONE OF THE HOMES

Figure 13

This cabin is the home of the individual designated III-4 in the chart. It is difficult to get a true idea of conditions with one picture, as the average home in the region should be available for comparison. It must be realized that Central Kentucky, where this family has lived, is a rich farming region, in which much more pretentious homes are the rule.

pears, to tell a falsehood even when the truth would be more convenient and when there can be no purpose for the deception. Strange though it may appear, he is fairly honest in so far as he is capable of distinguishing between right and wrong. He claims to lead a religious life, and has taken membership with as many as six different churches of various denominations. He boasts often that he never told a lie. He is willing to work at any kind of unskilled labor, but he is seldom employed because of his inability to perform the task properly, and when he is employed his wages are almost nothing. He and his wife have spent periods in almshouses and they are always dependent to a great extent upon charity. His wife is scarcely more than an imbecile. She is totally blind in one eye and has almost lost the use of the other. Although the cause was not learned, it was found that for a number of years she has had great difficulty in walking. Her ancestry could not be traced. Their offspring numbered two, one apparently quite superior to the other.

Of generation III, the two daughters, III-1 and III-6, never married. One of them died during childhood and the other could not be located. Very little was learned about her except that she was of higher intelligence than the average of this family.

III-2 is a very low-grade moron, and like his brother, III-4, he is noted for being a liar. He is illiterate and lives in poverty. His wife is of low intelligence.

Their son, IV-2, is probably the most notorious individual of the clan. He is feeble-minded, illiterate and shiftless. He, too, is known as a liar, and many small thefts and depredations have been laid to him. In a childish quarrel he shot and killed an eleven-year-old negro boy, an act for which he served a

term in a penitentiary. He has now returned to his old life, and has been allowed to marry and have children. His wife, IV-1, is a low-grade moron and a prostitute. Their children are yet so young that nothing of interest could be learned about them.

IV-3, with the exception of III-3, was the only individual who was reported to be as much as "fairly intelligent at school," and he died about the age of fifteen.

IV-4 is about the same type of individual as IV-1—illiterate, feeble-minded, and one who practices prostitution. Her husband is a low-grade individual, illiterate, feeble-minded and shiftless. His reputation is that of a liar and a thief. Due to his shiftlessness, they live in dire poverty. He has been refused aid from charity funds and ordered to find employment. He, by the way, is near-sighted and an albino.

They have two children. The older, a boy of five years, can not speak a word. It is reported that the father treats him very brutally. Neither of the children show albinism.

This clan is one which seems to become more and more unfit socially with each succeeding generation. This is probably due to their inter-marriages with other individuals of the same or of a lower class. They are certainly undesirable in any community, because:

1. Owing to their thievery and their constant need for aid from charity funds they are of considerable economic importance to the community and to the county in which they live;
2. They are representatives of a morally and mentally degraded and degenerating class—one of the most dangerous dysenic classes which society has to confront because it is allowed more freely perhaps than any other to perpetrate its kind;
3. The criminal tendency appears to be present in their germ-plasm, and no one knows how it may be expressed in future generations.

The elimination of this class is one of society's greatest problems. These people are allowed to go about unhindered and unsuppressed, every community in which they reside being satisfied if it can get them to go to another. This is a selfish attitude and one from which no positive result, in the eugenic sense, will be obtained. Those that are already with us we have to deal with, but the gravest danger to society does not come directly from them but from their descendants, who are practically always of the same kind. How to suppress and to stop their reproduction is a big problem, and one which perhaps can be solved best by a well-informed and well-enlightened public opinion.

Literature Cited

DARWIN, LEONARD. *Eugenic Reform.* Pp. 186-205. London, 1926.

DODGE, ERNEST. Bettering the Birth Rates. *Jour. Herd.* 15:113-188. 1924.

EAST. E. M. Hidden Feeblemindedness. *Jour. Herd.* 8:215-217. 1917.

ESTERBROOK, A. H. The Jukes in 1915. Carnegie Instit. Washington, 1916.

HANSON, F. B. The Pratt Family: A Record of Human Inbreeding for Eight Generations. *Jour. Herd.* 15:207-210. 1924.

HUMPHREY, S. K. The Menace of the Half-man. *Jour. Herd.* 11:228-232. 1920.

LUNDBERG, E. O. A Social Study of Mental Defectives in New Castle County, Delaware. U. S. Dept. of Labor, Children's Bureau, Pub. No. 24:1-38. 1917.

POPENOE, PAUL, and R. H. JOHNSON. *Applied Eugenics.* Pp. 176-183. New York, 1923.

An Animal Genetics Text

ANIMAL BREEDING, *by* LAWRENCE M. WINTERS, University of Saskatchewan. x+309 pp., 66 figures. Price $2.75. John Wiley & Son, New York, 1925.

The already extensive list of texts on genetics has another added to it in Winter's recent book on Animal Breeding, which is issued as a companion volume to Jones' *Genetics in Plant and Animal Improvement.*

The subject matter has been divided

into four parts: I. The Foundation, which presents briefly the economic and biological background; II. The Physiology of Reproduction; III. Heredity, which reviews the subject matter of genetics and discusses its application to animal breeding; IV. Practice, which sets forth the past and present methods in animal improvement.

The first two parts are, as their designations indicate, concerned primarily with physiology and embryology. Although the various topics are rather well presented, many of the discussions are exceedingly brief. In the chapter on sex no mention is made of the mechanism of sex determination in birds. In view of the fact that poultry furnishes one of the best illustrations of sex-linked inheritance in domestic animals, this omission seems rather unfortunate.

The reviewer was most disappointed with that part of the book in which heredity is discussed. A clear and concise statement of Mendel's experiments with peas and the conclusions which he drew from his results is never out of place in any text which deals with genetics. Prof. Winters, however, has preferred to draw all his illustrations of Mendel's law from cattle breeding and it is questionable whether this method has made the fundamentals of Mendelism as clear as they might have been. The first and second generation expectations in a mono-hybrid and a tri-hybrid cross are explained by diagrams but the F_2 results in a di-hybrid cross are not explained either in the text or in a diagram. The author starts to explain such a cross between Aberdeen-Angus and Shorthorn cattle but goes only as far as to say "that the F_1 offspring are black and polled while in the F_2 generation segregation for each pair of characters behaves independently." Does the author assume that all who read the volume have had sufficient training in genetics to be able to understand without having to be shown? Indeed, it would seem that this is the case, inasmuch as Winters clearly indicates in the Introduction that his book is intended to follow the elementary course. The reviewer wonders what would comprise an elementary course which gives less than is contained in the present volume.

In the chapter which deals with blending inheritance the author makes the rather startling statement that "Galton's Law of Ancestral Heredity is one of the greatest if not the greatest of the practical contributions of biology to animal breeding." In view of the fact that a majority of geneticists have for some time regarded both Galton's law of ancestral heredity and his principle of regression as chiefly of historical interest, it would seem that a qualifying statement should have been made.

The author's treatment of systems of breeding and the principles of selection is too much abridged to be really useful to either the student or to the animal breeder. The author seems to have failed to understand that a mere compilation of numerous paragraphs which do nothing more than mention such things as line breeding, inbreeding, grading, selection, and similar topics, does not constitute a guide to the art of breeding. The pure line concept, mass selection, and the genetic interpretation of the effects of selection are all conspicuous by their absence. Indeed most of the things which are really valuable in obtaining a clear understanding of the application of the principles of genetics to animal breeding either have been omitted or are poorly presented.

There are a few typographical errors, such as the use of the term "albinoism" throughout the text and the statement on page 118 that where three independent factors are involved in a cross, the chances of recovering either of the grand-parental types in the F_2 is 1 in 62.

On the whole, it may be said that the book excels in no respect and is decidedly deficient in many ways to even the most ordinary text written on the subject during the past ten years.

H. C. M.

THE PROBLEM OF ADAPTATION

A Review

FOR those who find pleasure in miscellaneous items of nature lore Professor Cuénot's new book *l'Adaptation* will provide much enjoyable reading. Professor Cuénot, however, presents this interesting collection of data, drawn from wide sources in the field of botany and zoology, merely as illustrative material in a lucid and stimulating analysis of one of the central problems of biology. The discussion is not one which leads to any new and far-reaching generalizations. It serves rather to review important opinions, to call attention to many minor fallacies and to emphasize the inadequacy of certain biological notions.

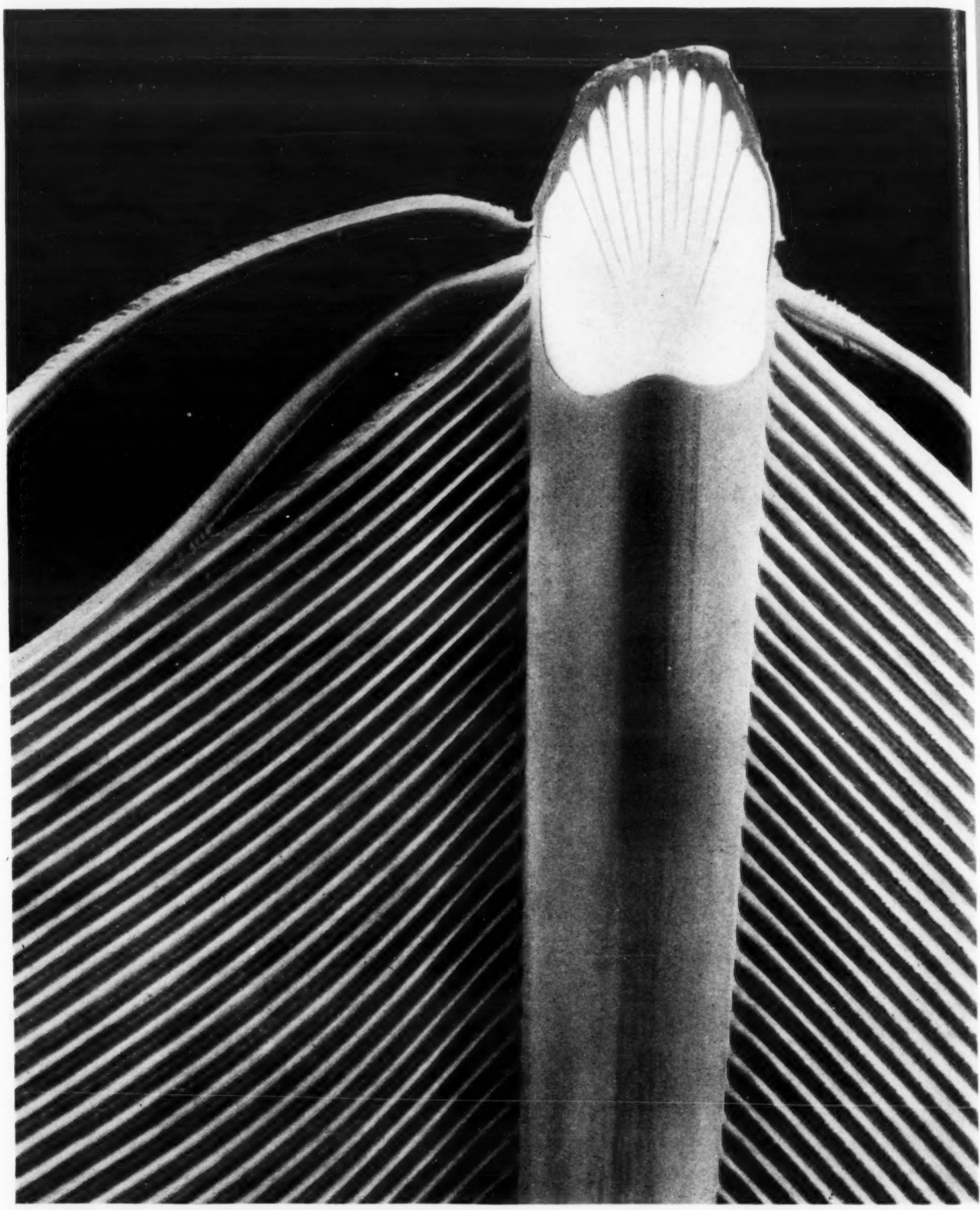
Adaptations and Accommodations

The word adaptation is commonly used to indicate two classes of phenomena which in some respects at least are quite different. One may properly distinguish between adaptations which have become hereditary characteristics of a species and those which are acquired by certain individuals during their own lifetime. The latter Cuénot prefers to designate as accommodations. If it could be shown that accommodations achieved by the parent may be transmitted to the offspring as pre-established adaptations this distinction would be less important; but even such spectacular claims as those of Pavloff leave the author still convinced that no unassailable evidence of the inheritance of any "acquired character" whatsoever has yet been presented. Nevertheless the interrelation between accommodations and fixed adaptations is an interesting and curious one, and it is often difficult in practice to distinguish between these two phenomena.

The capacity for accommodation, although widespread, is erratic and often defective. Many plants and animals are so deficient in this direction that their very existence is dependent on some special environmental complex. Others readily adapt themselves to conditions which they would never meet under normal circumstances, while failing to respond adequately to contingencies that arise repeatedly in their native haunts. In the "defense mechanism" especially are there many and outstanding weaknesses which, along with the rest, might easily give rise to the suspicion, if not the conviction, that the power of adjusting to new conditions is essentially haphazard.

Besides instances of accommodation which occur without any obvious relation to the past history of the species, there are others which are possibly of a different order. A Sagittaria plant growing in a gradually drying pond may produce successively: submerged phyllodia, weak floating leaves and broad, firm aerial leaves. Here we have a nice progressive accommodation to a changing environment. Such accommodations do not indicate a change in the germplasm, but simply successive responses of the same germplasm to varying environmental conditions. In this and similar instances, with which everyone is familiar, most of the possible accommodations are made by each individual. But there are other forms in which this is not the case. Many plants which are stable in the lowlands become greatly modified when transplanted to high altitudes. Some of them ultimately assume alpine characteristics, undergoing marked changes in habit, pilosity, leaf form and floral color. G. Bonnier has shown that after a period of years

L'Adaptation, by L. Cuénot. Pp. 420. 82 figures in the text. Gaston Doin, Paris. 1926. (This is one of a series of volumes published under the general title *Encyclopedie Scientifique*, edited by Dr. Toulouse. The volumes relating to general biology are edited by Prof. M. Caullery.)



EXAMPLES OF ADAPTATION IN A FEATHER

Figure 14

A feather, as a whole and in the structure of its component parts, affords many excellent examples of adaptation. In this picture the shaft of the feather has been cut through at an angle, to show its internal structure. It consists of a hard outer layer filled with a very light "pith." Bands of the horny covering extend inward from the upper side—where they must certainly serve an important function in increasing the rigidity of the shaft. The individual "featherlets" of which the feather is made up, are held together by the interlocking of the fuzz on their two sides. The upper ones have been pulled apart to show this. If they become separated they almost automatically fasten themselves together again. In the finished feather a number of adaptations have been brought together to form a light, strong, easily repaired surface—such as is required to make flight practicable. How the various components were assembled to produce the finished mechanism is a mystery which no theory of evolution altogether explains.

certain plants may even become completely metamorphosed. Thus *Leontodon proteiformis* (Will) at the end of six years in a high altitude had become *L. alpinus* Will; *Helianthemum vulgare* Gaertn, after thirty years become *H. grandiflorum,* D. C., etc. "All these modifications are evidently reversible accommodations" which may be produced promptly by sowing the seeds of a lowland plant in the mountains, when the alpine characters appear at once. Among many parallel cases in other groups may be mentioned a seasonally dimorphic butterfly of Eurasia. *Vanessa levana,* small and light brown with dark spots, appears in April and May to deposit eggs which give rise to the *prorsa* form of midsummer. The latter is brownish black with white spots and much larger. In Siberia, where there is only one brood a year, *prorsa* does not occur. Phenomena such as these serve to remind us that we know an organism only in relation to the environment where it is found, and it is consequently no easy matter to distinguish between accommodations which are well established alternative conditions and those (if any) which are directly and specifically induced by some new set of circumstances. The relation between accommodations and similar or identical hereditary traits, while simple enough for the Lamarckian, is very puzzling to the modern biologist. Cuénot gives much space to various aspects of this problem, but without being able to make any very constructive suggestions. It is, of course, conceivable that, granted a certain capacity for accommodation, this alone might enable a species to maintain itself until random mutations had fixed the desirable traits in hereditary form. But no one is more willing than Cuénot to admit that such an assumption would be a bit farfetched.

Pre-Adaptation to New Conditions

But while an occasional species is able to assume a form appropriate to an environment in which it is not ordinarily found, most species are unable to do this, or do it very imperfectly. How then does a species become established in a new environment? Cuénot's answer is by *preadaptation.* When a void is to be filled only such species can establish themselves as are *already* adapted to the new conditions, or can at least readily accommodate themselves. It would seem to be beyond question that of the various species which filter into a region the only ones to gain a permanent foothold will be those which are already sufficiently adapted to the new conditions to maintain themselves there. During the war large areas of Belgium were flooded, but the flora which had previously been established there, instead of becoming aquatic, gave way to another flora which was already adapted to the new conditions. Subsequently, with reclaimation of the inundated area, the new flora disappeared in its turn and the old reestablished itself.

The concept of pre-adaptation implies that characters may arise essentially without reference to any particular environment, and this indeed is the burden of much of the discussion. Thus, while many cave animals are blind and largely unpigmented, there is no evidence that the cave life creates these conditions. Similar forms frequently occur outside of caves, so one may well wonder if this special fauna does not simply represent a collection of forms which have filtered in and persisted because they are better able to live there than anywhere else. It is not the cave that has made the fauna, but the fauna that has taken advantage of the cave. Many instances will occur to the reader of introduced species that have thrived remarkably in some new environment.

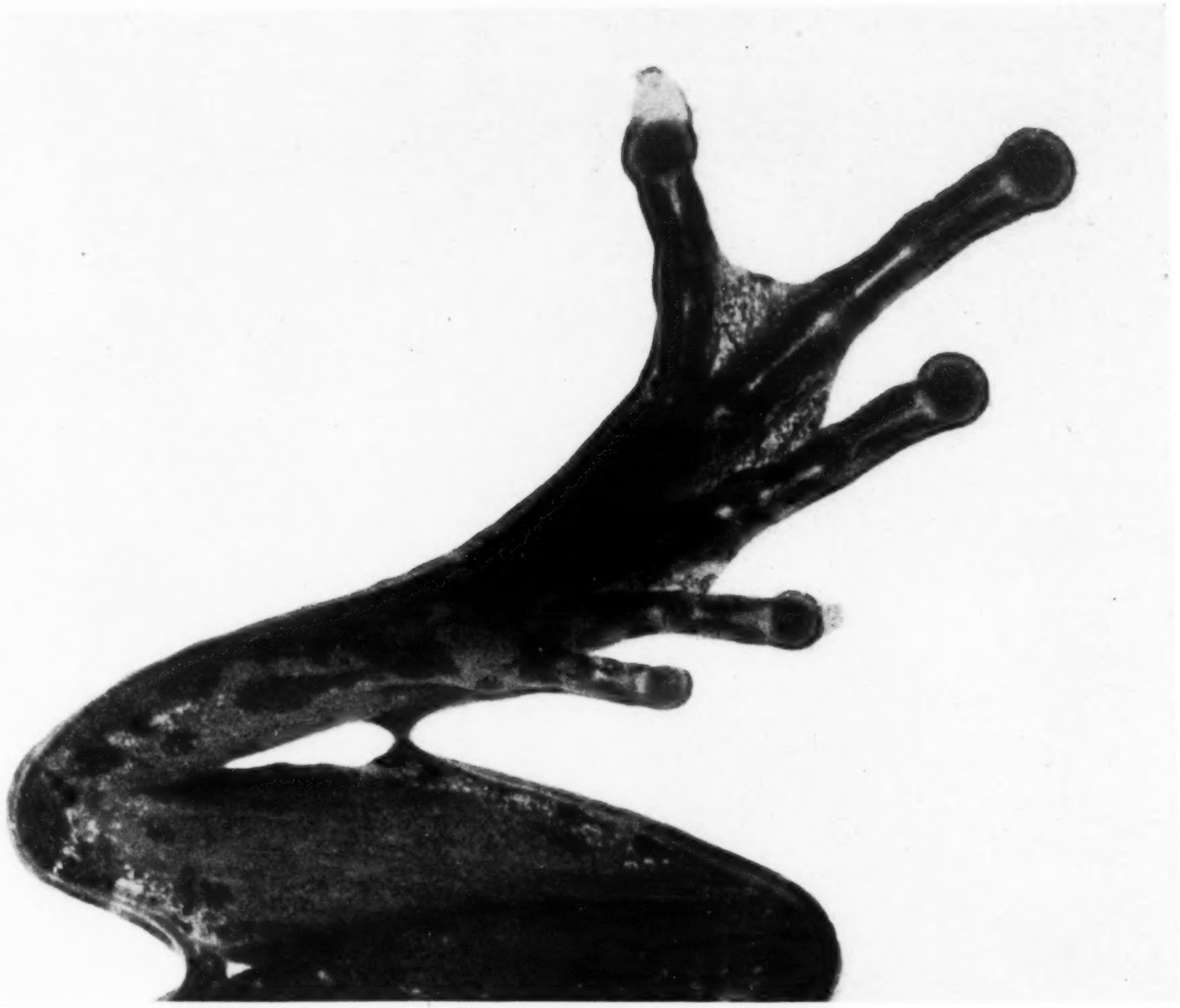
Imperfect Adaptations

But if the flora and fauna of a region represents simply a congerie of species which are able to maintain themselves in that particular environment it might be expected that many "adaptations" would be quite imperfect and that there would be some characters of negative

THE CUPPED "TOES" OF A PLANT

Figure 15

Enlarged photograph of the tendril of an ivy vine—showing the adhesive discs attached to a board. The development of similar adaptations in unrelated forms is one of the puzzles of evolution which is "explained" by the term "parallel development." This simply acknowledges a fact but it does not tell us how it comes about that similar solutions of a problem of adaptation are frequently hit upon by organisms which are otherwise very different. Photograph by Robert Cook.

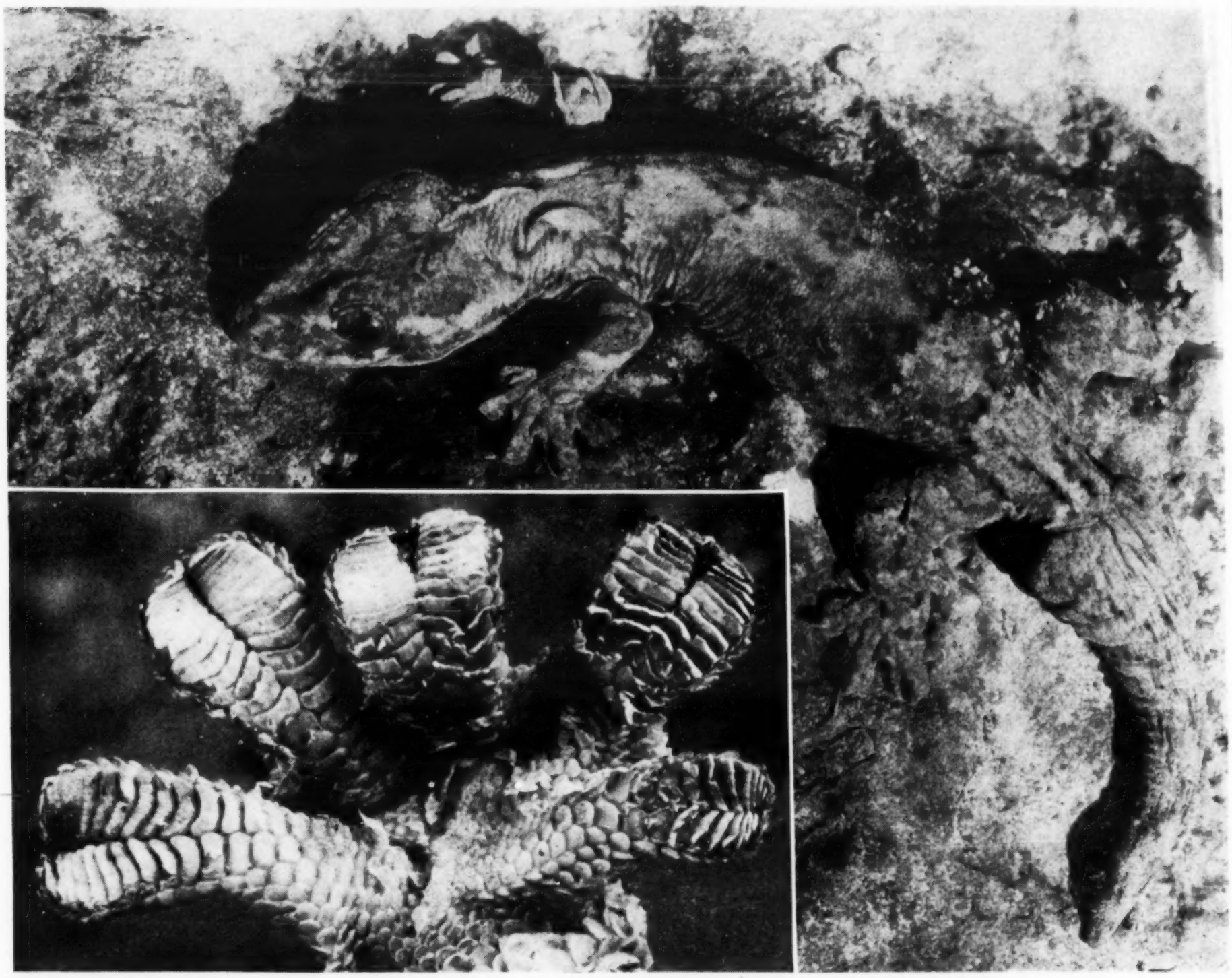


"VACUUM CUP" TOES

Figure 16

Much enlarged photograph of the foot of a "spring peeper" (*Hyla crucifer*) showing the cup-tipped toes; adapted for climbing on smooth surfaces. The photograph was made through the pane of glass on which the frog was hanging. Cuénot points out that in the living world can be found analogues of almost every human device except the wheel. Man has recently applied the vacuum cup principle in a number of ways, but it is hardly to be considered new when animals and even plants have been using it for millions of years. Photograph by E. L. Crandall and Robert Cook.

or indifferent value. Probably every careful observer will agree with Cuénot that such is the case, although perhaps not everyone will agree entirely with his selection of examples to illustrate this point. Emphasis is laid upon a group of structures which are perhaps of some functional importance, but really unnecessary. The swim-bladder of a fish is an organ which 'has a physiology' and plays an important rôle in the economy of the individual which possesses it but, if one may judge from the speed, strength and grace of fish in which it is lacking, it appears to be a wholly *unnecessary* structure. If it be objected that swim-bladders confer some important, but to us unappreciated advantage, it may be asked why have not more fish evolved them? We have become too prone to assume as axiomatic that every manifestation represents some form of adaptation. It may at first appear that thorns and acrid taste have been acquired by some plants as protection against herbivorus animals, but if so, and adaptation is so easy, why have not other victimized species protected themselves? Time and again it seems to be merely good fortune that gives



ANOTHER FORM OF "NON-SKID" TOES
Figure 17

The toes of the Gekko (*Thecadactylus raficandus*) look like cups from above, but from below they show a quite different arrangement. The under side of the feet is equipped with scales, some of which have fine teeth on them, as is shown in the enlarged insert. For climbing on rocks they appear to perform their function just as efficiently as the cupped toes of the frog.

The Gekko stores fat in the enlarged part of his tail, and this is utilized during lean periods. Like other lizards, his tail is rather loosely fastened—which is considered an adaptation to aid him in escaping from enemies. Unfortunately the Gekko loses his food reserve with his tail, so the two adaptations seem to work against each other, though it might be argued that it is better to escape hungry than not to make one's getaway at all. This species of Gekko is native to Central America and the individual shown here was photographed at Chitzen Itza, Yucatan, by E. L. Crandall. The Gekkos are great travelers and they have been widely distributed in tropical countries. They are sometimes found in bunches of bananas, in which they have "stowed away" during the trip to the States. Photograph courtesy of U. S. Department of Agriculture.

this or that species an advantageous attribute. The web foot of the duck is not, as Cuénot sees it, the result of an at present aquatic habitat, but a heritage from some remote ancestral Hesperornis. It is not that most aquatic birds have acquired the web, but that most land birds have lost it!

Similar examples might be cited almost without end, but they do not suffice to explain away the fact that so many really marvelous adaptations do occur. Among the most wonderful of these are the adaptations of different parts of the same body, "coaptations." In the discussion of these cases Cuénot is in a familiar field to which he has long given attention. He reminds us that one may find in the animal body analogues of the snap,

the tongue and groove, button and buttonhole—indeed every human device he can think of except the wheel. Not the least remarkable aspect of these coaptations is the fact that parts which are later to show such perfect reciprocal relations not infrequently develop without mutual contact or other obvious relation to each other in the embryo. These are, however, not entirely different from the organs which are fully developed in "anticipation' of their function in relation to some environmental contact.

The Problem Unsolved

If, now, the biologist is asked to "explain" these things it must be admitted that he is not yet in a position to do so. Lamarckianism fails to offer a solution since it has turned out that the power of immediate accommodation is limited and even what little is achieved in this direction by certain individuals cannot be passed on to the offspring. Darwinism also falls short because on the one hand the rigidity of natural selection has been greatly exaggerated, and on the other hand it makes no provision for the evolution of structures which could have no selective value, or only a negative one up to such time as a high degree of "useful" specialization had been attained. Finally mutationism is inadequate for about the same reason as Darwinism—the improbability of many coordinated changes occuring simultaneously in such a way as to give rise to some complex and immediately functional new structure.

None of these theories seem to offer much toward an explanation of a large class of cases which may be exemplified by the click beetle. This insect presents a highly specialized coaptation of parts which enables it to snap itself into the air when placed on its back. Anything short of virtual perfection in this mechanism (and the instinct to use it) would result in complete inability to perform the feat. How did it come about? "Ignoramus." But in this connection, as in many others, there is an interesting, and presumably significant fact; several related species have the same parts, but in an imperfect and functionless form. They appear to represent lower stages in an orthogenetic series. The process of orthogenesis, a kind of progressive stubborn advance along definite lines, is common to the animal and vegetable kingdoms. It is this which Lamarck and Darwin have tried, and largely failed, to explain. *There is some important factor which still eludes us.*

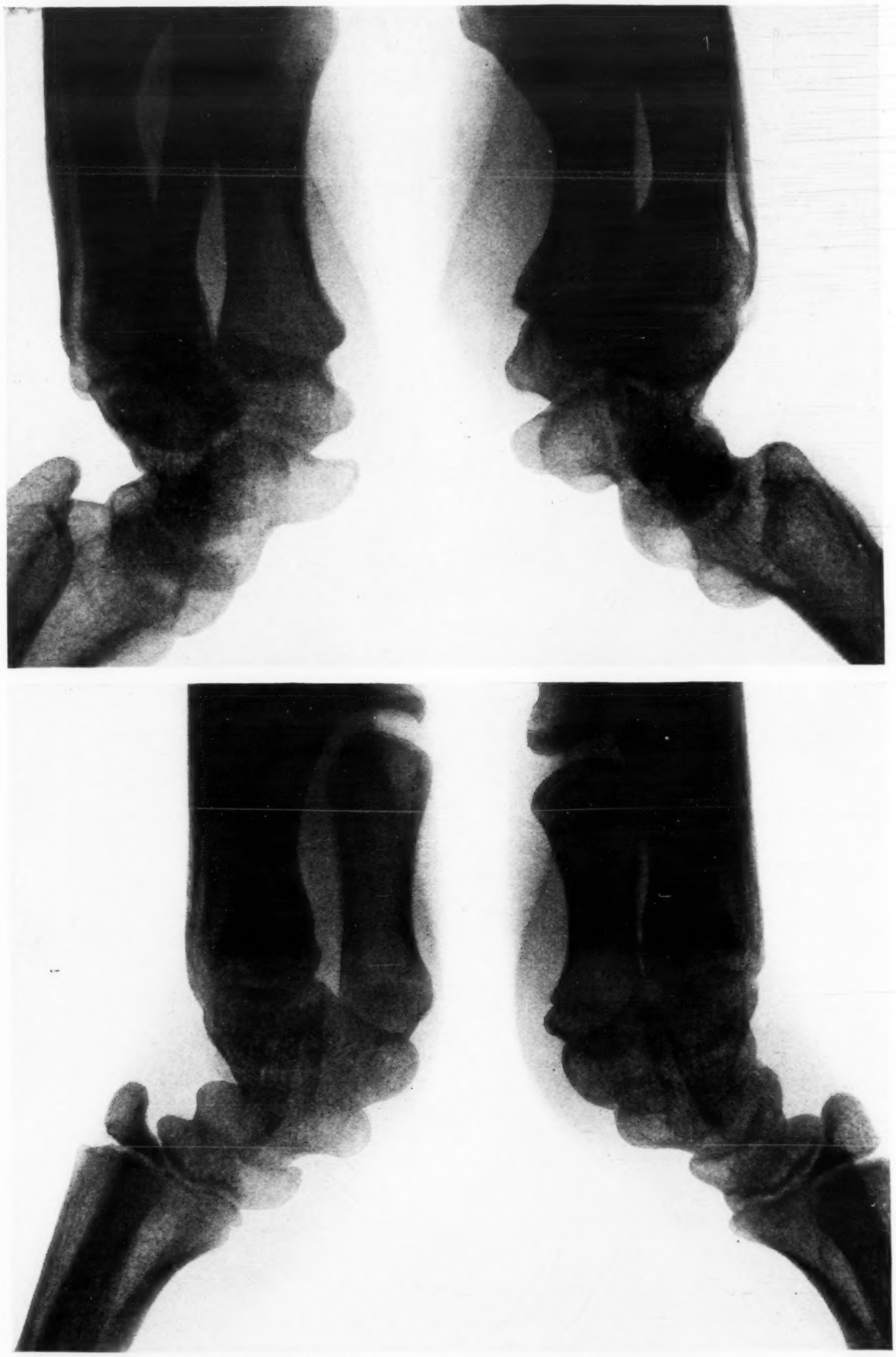
In reviewing a book of such general scope one has reluctantly to pass over much that is important. It must suffice to say that in addition to the points indicated there is in *l'Adaptation* an interesting discussion of the reason for the scarcity of "missing links," the abundance of palæontological evidence for change of structure, the rarity of evidence for change of form and, finally, an interesting, if not very significant, section on the metaphysics of adaptation. There are occasional inaccuracies and not a few arguments which may fail to convince, but such minor defects are entirely overshadowed by the wealth of material and the illuminating analysis to which it is subjected.

C. H. Danforth.

An Outline of Eugenics

RASSENHYGIENE, by K. H. BAUER, Pp. 247, with 28 illustrations, price $1.75. Verlag von Quille & Meyer, Leipzig, 1926.

This is one of the most popular expositions of eugenics written by a young surgeon of the University of Göttengen, who has made numerous contributions to the study of heredity and race hygiene. *P. P.*



TWO GENERATIONS OF DISPLACED CARPALS

Figure 18

The X-ray photographs show the displacement of the carpals, which is brought about by excessive growth of bone. Above are shown the hands of the mother; below, those of the daughter. The photographs are taken through the hand, with palms facing each other. It is difficult for the normal hand to bend back to such an acute angle. The mother's wrists are more deformed than the daughter's, due to the continued deposition of bone with advancing age. Photograph by Louis A. Thody.

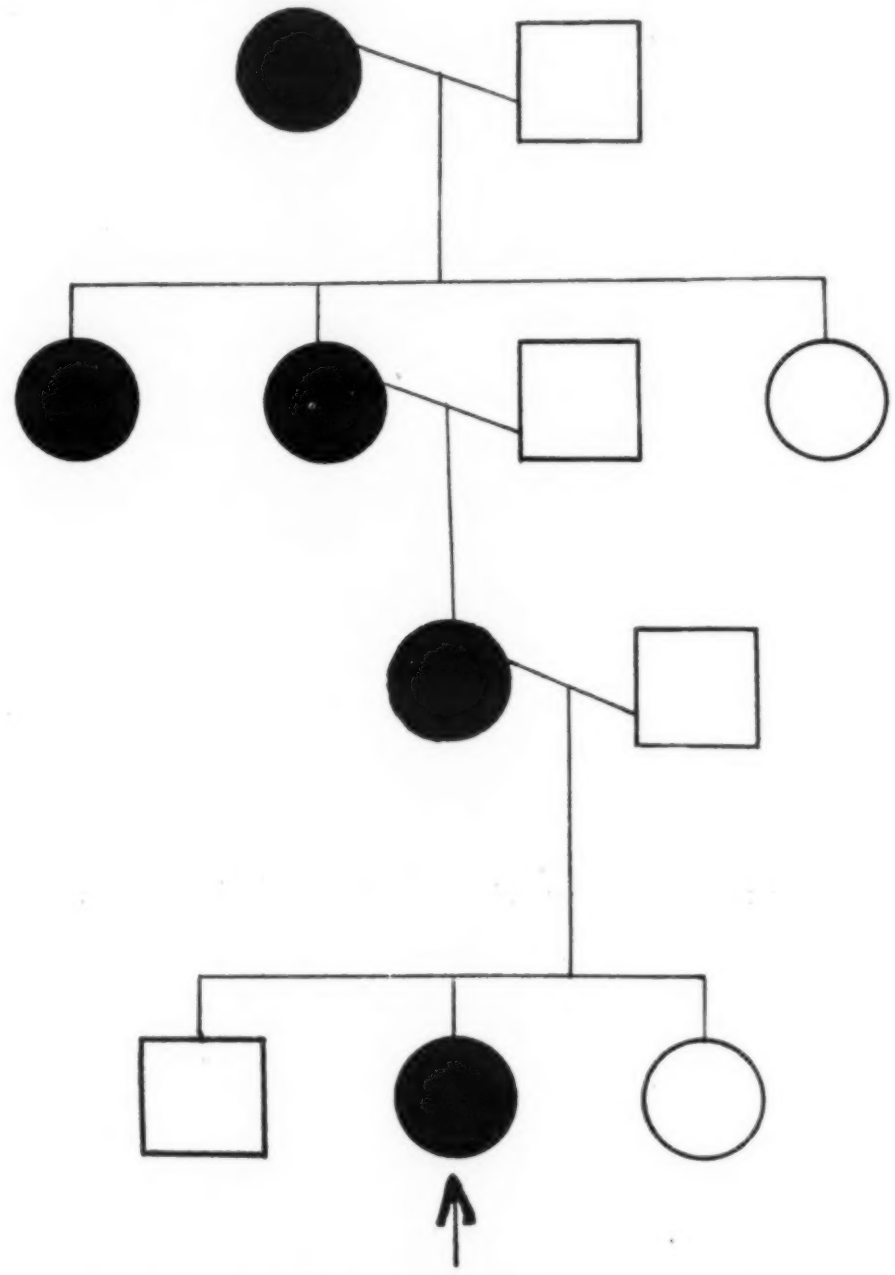
INHERITANCE OF CARPAL DISPLACEMENT

HARRIET A. ELLSWORTH
University of Utah

A PECULIAR trait which seems to be dominant was recently brought to the writer's notice. A girl, ten years of age, was X-rayed for a fracture of the arm. The X-ray plate was returned showing the fracture, and this further report: "The carpus is dislocated forward on the radius and ulna, and there is a deformity of both articulations of the wrist." It will be noted in the X-ray photograph, that while carpal displacement occurs at a very early age, the deposition of bone causing malformation of the carpus takes place slowly with advancing age, and is, therefore, much more pronounced in the mother than in the immature propositus.

The fraternity is small in numbers, yet the character frequently appears, as the family chart shows. Those individuals left blank on the chart showed no evidence of the trait. From the chart it appears to be a sex limited character, however, this probably would not be the case if there were more male offspring.

This is evidently a simple Mendelian character, needing only one determiner in the germ plasm to cause it to become somatically visible. It is well determined in the individuals which do show it.



INHERITANCE OF DISPLACED CARPALS FOR FOUR GENERATIONS

Figure 19

A scarcity of males makes conclusions hazardous, but a dominant mendelian character is suggested.

The writer wishes to explain that she was enabled to secure these data through the kindness of Dr. Louis A. Thody. The propositus and the mother willingly coooperated in giving the family history.

The Mixing of Races

POPULATION problems are inseparable from eugenics, for eugenicists are devoted to altering the rate of increase of various components of the population. The present book* is thus of special interest, since it is an attempt to present the subject of population in popular form. Professor Reuter is in the main to be congratulated on his success, though his treatment of hereditary differences and race questions is hardly on a par with the rest of the book.

The rate of increase of population

*Population Problems by E. B. Reuter, pp. XVII-338. Price $2.00. J. B. Lippincott, Philadelphia, 1925.

is governed by the birth rate and the death rate. The so-called checks on population either lower the birth rate or raise the death rate, and such checks are legion. Starvation has been one of the most potent of these, since it does both. During the nineteenth century at least forty million people died of famine in India and China—probably the total would be twice this number if all the local famines were included and this takes no account of the reduced birth rate due to starvation conditions. With modern systems of transportation the effcts are none the less real. Incidence of famine is changed, but increased food prices cause suffering and malnutrition among the poor over a wide area, instead of death for a smaller number in the famine region.

Disease, war, and floods also take their toll of human life. Social customs sometimes play an important part: "Miss Kingsley states that executions for witchcraft cause more deaths in Africa than does the slave trade or any other single cause."

Other checks are also discussed at length, both as to their effect on quantity and quality. Throughout, the author minimizes the importance of hereditary differences, although he does concede that they exist. "Evolution of the human race is at a standstill."

The negro problem is dealt with in the chapter in race and race mixture. Since the author believes that the effect of heredity is "easily and generally exaggerated" the problem is not difficult of solution: amalgamate the two races as fast as possible. There are no essential differences between races so the resulting mulatto population will be as good or better than the original. Reuter admits that psychological tests and the experience of teachers definitely indicate measurable differences between the races, but these are dismissed as being largely due to racial prejudice or to cultural advantages. The admitted superiority of the mulatto over the negro is also cultural—he is given better opportunities and therefore is better endowed. The author is emphatic in his assertion that the mulatto is not inherently superior and hence able to take advantage of better opportunities.

With scientific data as scarce as it is admitted to be, conservatism with regard to proposals to hasten race mixture is the only wise policy. It is easy enough to mix races but once the harm is done the un-mixing is not so simple. If biology is not arbitrarily ruled out, it may even help to explain the superiority of mulattoes, and why some of them are so much more promising than others. As popularly used the term "Mulatto" includes several types of hybrids which may well differ in quality. Should the superiority of the first hybrid generation be due to heterosis (hybrid vigor) Reuter's mulatto civilization would be expected to collapse in a very few generations. In the absence of unequivocal evidence that a mulatto civilization would be a distinct improvement, this facile solution of the negro problem is more than likely the wrong one. In the course of time we may be thankful for such "childish" social customs as segregated schools and other duplicate social arrangements, which the author considers a serious and indefensible waste. *R. C.*

Shots from the Young Idea

Abstracts of Theses (Science Series, Vol. II). University of Chicago Press, 1926. Pp. 396.

Theses presented for the Ph.D. degree, 1923-4. They give an interesting picture of scientific activity in a modern American university. *P. P.*

BUD SELECTION IN THE WASHINGTON NAVEL ORANGE

Progeny Tests of Two Shape Variations—"Flattened" and "Pear-Shaped"

A. D. SHAMEL, C. S. POMEROY and R. E. CARYL
Bureau of Plant Industry, United States Department of Agriculture

IN an earlier publication[1] descriptions were presented of several marked bud variations in the Washington Navel orange together with a discussion of their relation to the origin and development of important strains of this variety.

Progeny tests of a number of limb variations of the Washington Navel orange have also been published[2] proving that variations of quantity and quality of crop are capable of perpetuation through bud propagation.

In the following pages a Flattened bud variation of the Washington Navel orange will be described and performance record data will be presented from progeny trees that were propagated from a limb variation of this strain.

The Flattened Strain

The Flattened strain of the Washington Navel orange has been found to occur as single fruit and as separate limb variations in trees of both the Washington and Thomson strains and entire trees of this strain have also been found occasionally in established orchards. The limb variation described herein occurred in a Thomson tree, but other observations and studies have proven that the origin and development of the Flattened Washington strain is similar to that of the Flattened Thomson strain excepting that it occurs in Washington instead of Thomson trees.

The trees of the Flattened strain are similar in appearance, habit of growth and foliage characteristics to those of the parent Washington or Thomson strain. The distinguishing characteristic of the fruits of the Flattened strain is their shape which is flattened at the stem and blossom ends. The fruits are of medium size, and the rind is similar in color, thickness and texture to those characteristics of the fruits of the parent strain. The rag is of medium quantity and the juice is fairly abundant and of fair quality. The fruits are seedless and have navels of normal size.

The flattened shape of the fruits is a considerable disadvantage in handling and packing operations. It is difficult with existing sorting machines to size the flattened fruits accurately, and it is also very difficult to pack the flattened fruits in the customary manner so as to make an attractive package. Furthermore, this unusual shape lowers the commercial value of the pack because it is markedly different from the normal shape of Washington Navel oranges.

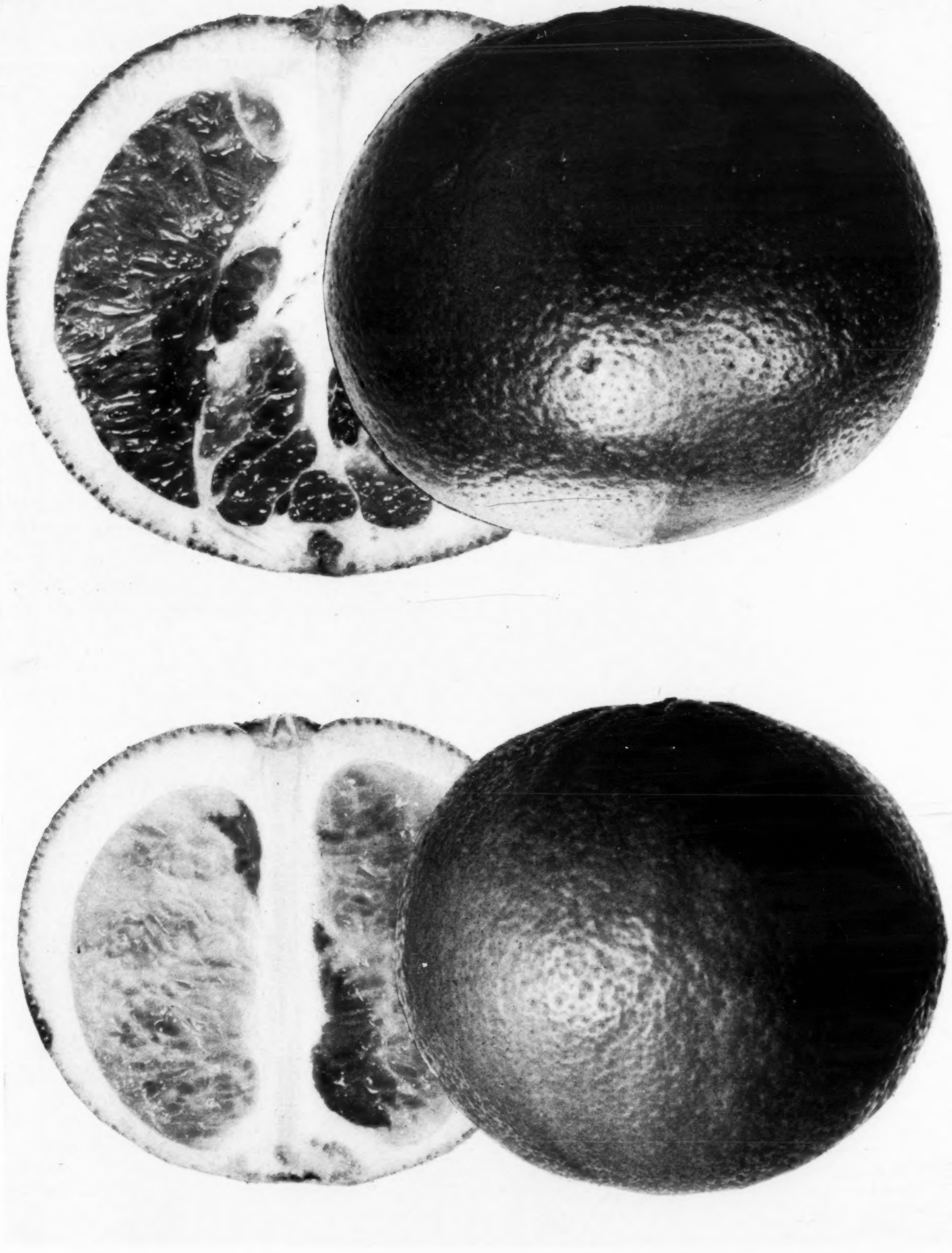
Flattened Strain Limb Variations

The Flattened strain limb variation reported upon in this paper was found in a Thomson tree in a Washington Navel orange orchard in the Victoria orchard of the National Orange Company at Riverside, California. The fruits borne by this limb were flattened in shape at both the stem and distal ends, the rinds were smooth in texture and reddish-orange in color, and the flesh and juice characteristics were similar to those of the Thomson fruits. Fruits from this limb variation are shown in Figure 20.

The remainder of the parent tree was typical of the Thomson strain in both foliage and fruit characters. The flattened shape of the fruits of the limb sport stood out clearly in comparison with the shape of the normal fruits on this tree.

Progeny Propagation

Two bud sticks with typical fruits at-



FRUITS OF THE FLATTENED STRAIN

Figure 20

Fruits from the parent limb variation (above) and from a progeny tree propagated from this limb (below). The shape of the fruits makes them undesirable for commercial purposes.

tached were cut from the Flattened limb variation on January 22, 1915, and buds from this wood were inserted in sour orange root-stocks shortly thereafter in a commercial nursery in cooperation with the Citrus Experiment Station of the University of California.

Two nursery trees from this propagation were set out in the progeny orchard of the Citrus Experiment Station on July 2, 1917. The trees in this orchard were set ten feet apart, the close planting providing for more progeny plantings in the space available than would have been possible with the usual spacing.

The progeny orchard has had normal cultural care for young citrus trees. Soil fertilization has consisted almost entirely of the growing of winter and summer cover crops which have been plowed under and the trees have made good growth continuously.

Progeny Performance Records

In Table I is shown the performance records of the two progeny trees of the limb variation of the Flattened strain together with a similar record for two comparative progeny trees that were propagated at the same time from the normal part of another nearby Thomson tree. This record shows the number of fruits produced each season during the five-year period of 1920-21 to 1924-25, inclusive.

The progeny trees 1 and 2, which were propagated from the Flattened strain limb sport have produced totals of 515 and 418 fruits, respectively, during the performance record period. As is indicated in the table the majority of the fruits have been typical of those borne by the parent limb variation though a number of them have been like normal Thomson fruits showing the unstable character of this variation. Two fruits from one of these trees are shown in Figure 20.

The fruits of the progeny trees of the normal Thomson parent trees have been normal for the Thomson strain. These two progeny trees have been normal for the Thomson strain. These two progeny trees have produced totals of 584 and 316 fruits, respectively, during the performance record period.

The difference in the fruiting of the progeny trees of the Flattened strain and those of the Thomson strain has been mainly one of shape of fruits and this difference has beeen unmistakably apparent to all observers.

These results also indicate that the Golden Nugget trees often found in Thomson and Washington orchards have doubtless been the result of the accidental propagation of bud variations.

The Pear Shape Strain

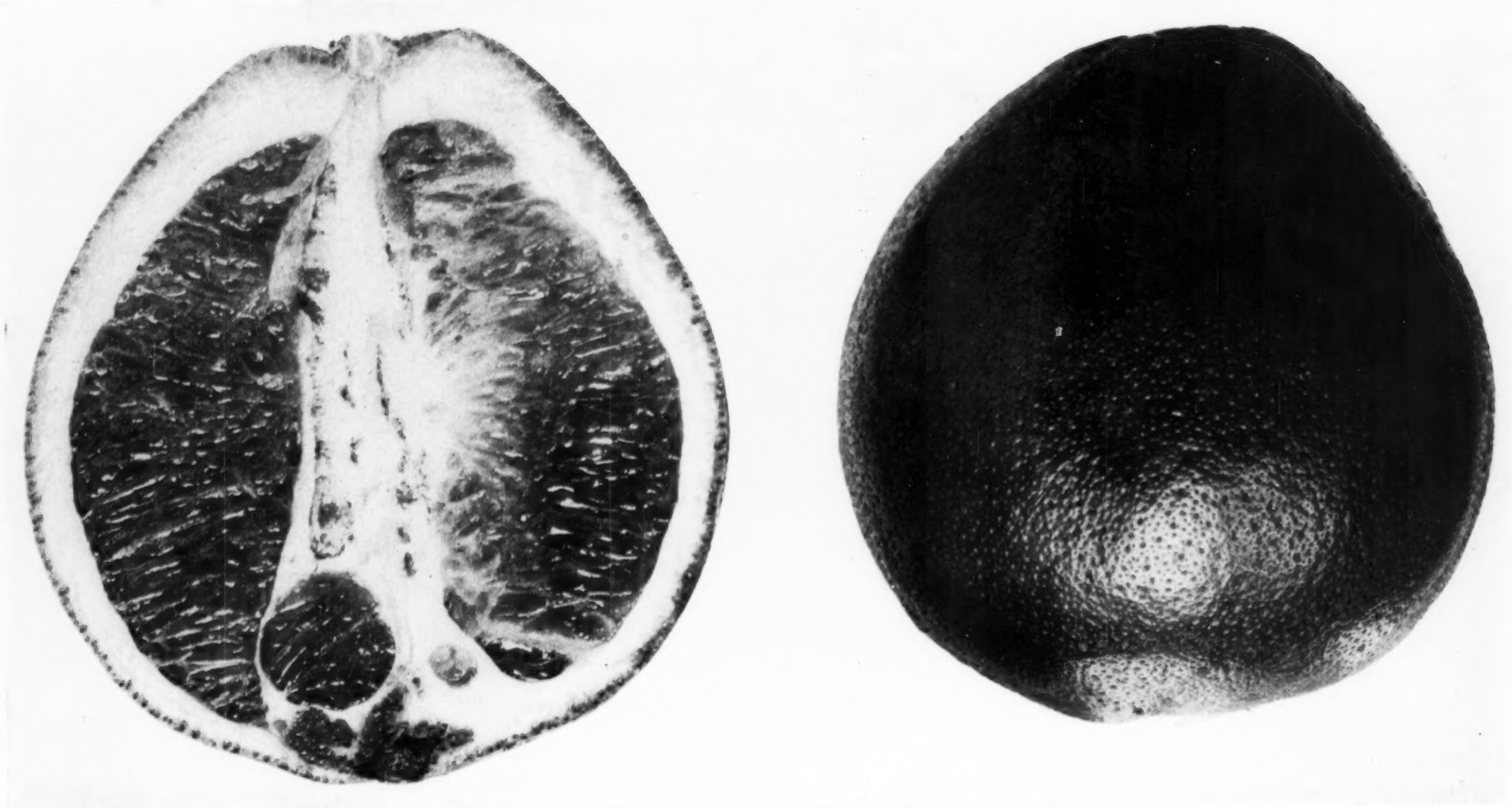
The trees of the Pear Shape strain have an upright habit of growth with rather sparse foliage. The leaves are sharply pointed in shape and are smaller than those of the trees of the Washington strain.

The fruits are usually of small size and are distinctly pyriform in shape with a rather large collar or neck at the stem ends. The rind is rather coarse in texture, and usually very thick and yellowish orange in color. The rag is fairly abundant and frequently coarse and the juice is small in quantity and of inferior quality. The fruits are seedless and the navels are usually enclosed.

This strain is of inferior commercial value on account of its small fruits, their abnormal shape and poor quality, but it is of more than ordinary interest from the standpoint of bud variation. It occurs as single-fruit, separate limb and entire tree variations.

Pear Shape Limb Variations

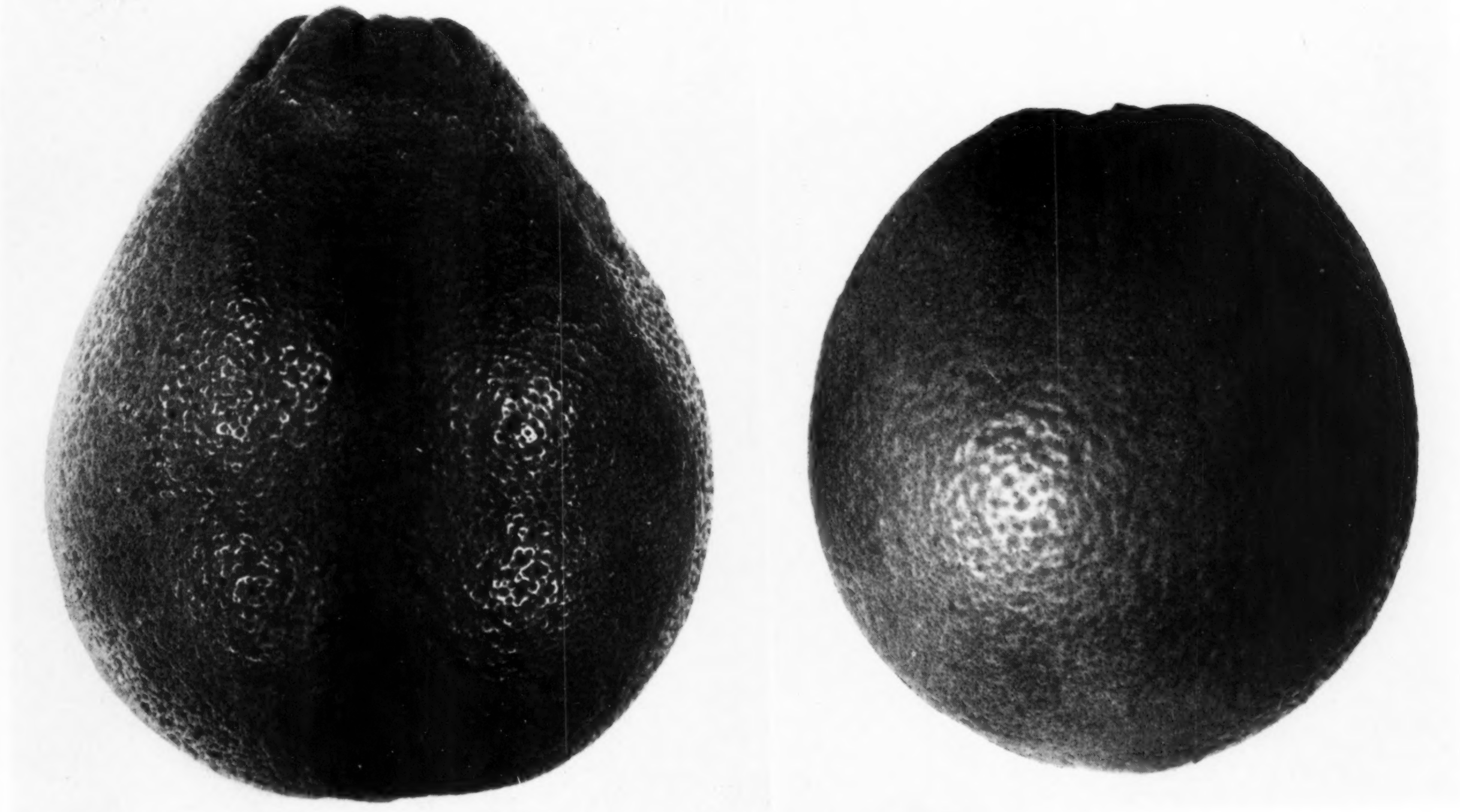
Limbs bearing pear-shape fruits have been found in both Washington and Thomson trees in several Washington Navel Orange orchards in the Southwest. The leaves on these limbs are



FRUITS OF PARENT "PEAR" VARIATION

Figure 21

Trees Number 5 and 6 in Table II were propagated from this tree.



FRUITS FROM PROGENY TREES

Figure 22

Fruit of progeny tree from "pear" limb is shown at left. The fruit at the right is from a tree propagated from the normal Thomson part of the parent "Pear" tree.

small, sharply pointed and light green in color. The fruits are pyriform in shape and resemble somewhat the shape of typical Bartlett pears in this respect, and for this reason are commonly called pear-shaped fruits. On account of their undesirable shape they are not adapted to packing in the established market containers. The rinds are likely to be coarse in appearance and the flesh is often coarse, lacking in juice and of poor flavor. Fruits from the limb variation from which trees 5 and 6 in Table II were propagated are shown in Figure 21.

Progeny Propagations

Budwood was cut from Pear Shape limb sports in three Thomson trees in the Victoria orchard of the National Orange Company of Riverside, Calif., in January, 1915. Budwood was also secured from a normal branch of one of these parent trees for propagation in comparison with that from the Pear Shape limb variation. At the same time budwood was taken from another Pear Shape limb variation in a Washington tree in the Vivienda orchard of the National Orange Company.

The buds were inserted on sour orange seedling rootstocks in a commercial nursery in cooperation with the Citrus Experiment Station of the University of California. Subsequent treatment was essentially the same as that given the progeny trees of the Flattened strain (Page 137).

Progeny Performance Records

The performance records of the progeny trees propagated from Pear Shape limb variations in three Thomson and one Washington parent trees, and from a normal limb of one of the same parent Thomson trees are shown in Table II for the five-year period, 1920-21 to 1924-25, inclusive. There are two trees of each progeny and the number of oranges on each tree each season is recorded. The fruits each year have been assorted according to their strain characteristics, the number of each being indicated in the table by the letters P for the Pear Shape, T for the Thomson, and W for the Washington strains. The presence of normal fruits on the off type trees shows the unstable condition of the Pear Shape strain as here presented.

A Pear shaped fruit from progeny tree No. 6 is shown in Figure 22, with a normal fruit from progeny tree No. 7.

These performance records show that the progeny trees from the Pear Shape limb variation have produced both Pear Shape fruits and typical fruits of the normal parent strains. The tendency in some instances is for the most of the crop to be of the Pear Shape strain fruit while in other cases the bulk of the crop is normal in character.

From the practical point of view this indication of inherent instability is of great importance and the propagation of this strain for commercial culture is undesirable.

The classification of the fruits during the picking of the progeny trees has been based wholly upon appearance and shape of the fruits. An examination of some of the oranges classed as normal Thomson or Washington has shown the typical thick rinds, coarse rag and inferior juice of the Pear Shape strain. It seems apparent that shape of fruit in these instances has been more or less unstable while the flesh and juice characteristics have been more nearly stable.

Conclusion

The results of these progeny tests prove that the two bud variations described are inherent and capable of perpetuation through bud propagation.

Shape of fruits is an important factor in the packing and marketing of the Washington Navel orange crop. The normal shape of the fruits of the Washington strain is admirably adapted for packing and marketing purposes. The flattened shape of the fruits of the Flattened strain is objectionable from both the packing and marketing standpoints under existing conditions.

The progeny trees of the Pear Shape limb variations have shown considerable instability so far as the shape of fruits produced by these trees is concerned. This condition as well as other similar instances where shape of fruits is concerned indicate that the shape of the fruit is quite variable.

The rind, flesh and juice characteristics of the fruits borne by the progeny trees have been like those of the fruits produced by the parent limb variations.

These demonstrate conclusively the importance of bud selection in the commercial propagation of citrus trees in order to avoid the accidental perpetuation of bud variations.

Literature Cited

1. Shamel, A. D., L. B. Scott and C. S. Pomeroy. Citrus-Fruit Improvement: A Study of Bud Variation in the Washington Navel Orange. *U. S. Dept. Agr. Bul.* 623, 146 pp., illus. 1918.

2. Shamel, A. D., C. S. Pomeroy and R. E. Caryl. Bud Selection as Related to Quantity Production in the Washington Navel Orange: *Jour. Agr. Research* 26:319-322. 1923.

———— ———— ————. Bud Selection as Related to Quality of Crop in the Washington Navel Orange. *Jour. Agr. Research* 28:521-526, illus. 1924.

———— ———— ————. Bud Selection in the Washington Navel Orange: Progeny Tests of the Thomson, Washington, Corrugated and Golden Buckeye Strains Originating as Limb Variations on a Single Tree. *Journal of Heredity* 16:232-241. 1925.

———— ———— ————. Bud Selection in the Washington Navel Orange: II.—Progeny Tests of Dry Limb Variations. *Journal of Heredity* 16:299-306, illus. 1925.

———— ———— ————. Bud Selection in the Washington Navel Orange: III.—Progeny Tests of the Australian Strain. *Journal of Heredity* 16:367-374, illus. 1925.

———— ———— ————. Bud Selection in the Washington Navel Orange: IV.—Progeny Tests of Limb Variations of the Ribbed Strain. *Journal of Heredity* 16:415-422, illus. 1925.

———— ———— ————. Bud Selection in the Washington Navel Orange: V.—Progeny Tests of a Sheepnose Limb Variation. *Journal of Heredity* 16:449-455, illus. 1925.

———— ———— ————. Bud Selection in the Washington Navel Orange: VI.—Progeny Tests of a Dual Limb Variation. *Journal of Heredity* 17:59-64. Illus. 1926.

TABLE I.—Records of annual production of progeny trees propagated in 1915 from a limb variation of the Flattened Strain which was found in a tree of the Thomson strain, in comparison with similar records of progeny trees of a normal Thomson parent tree.

Progeny Tree No.	Source	Number of fruits produced by progeny trees					
		1920-21	1921-22	1922-23	1923-24	1924-25	Totals
1	Limb variation of Flattened strain in Thomson tree 14-29-8	9 F*	56 F	23 F	125 F	88 F	301 F
		2 T*	42 T	34 T	92 T	44 T	214 T
2		8 F	48 F	11 F	96 F	104 F	267 F
		4 T	23 T	19 T	60 T	45 T	151 T
3	Normal portion of Thomson tree 14-23-9	33	136	63	191	161	584
4		15	28	55	177	41	316

*F indicates fruits of the Flattened strain and T indicates those of the normal Thomson strain. All the fruits borne by progeny trees 3 and 4 were typical Thomsons.

Table II on Page 142

TABLE II.—Records of annual production of progeny trees propagated from four limb variations of the Pear Shape strain occurring in trees of the Thomson and Washington strains with records of two progeny trees propagated from the normal portion of one of the same parent trees.

Progeny Tree Number	Source	Number of fruits produced					
		1920-21	1921-22	1922-23	1923-24	1924-25	Totals
1	Limb variation of the Pear Shape strain in Thomson	3 P	19 P	48 P	4 P	59 P	133 P
		1 T	2 T	69 T	27 T	62 T	161 T
2	14-5-3	2 P	9 P	7 P	29 P	31 P	78 P
		2 T	3 T	9 T	222 T	57 T	293 T
3	Limb variation of the Pear Shape strain in Thomson	26 P	10 P	15 P	178 P	108 P	337 P
		0 T	0 T	9 T	24 T	25 T	58 T
4	tree 14-29-8	5 P	5 P	29 P	216 P	184 P	439 P
		1 T	0 T	15 T	88 T	39 T	143 T
5	Limb variation of the Pear Shape strain in Thomson	24 P	62 P	34 P	14 P	13 P	147 P
		0 T	24 T	7 T	75 T	34 T	140 T
6	tree 14-23-9	47 P	181 P	128 P	449 P	142 P	947 P
		3 T	2 T	11 T	32 T	19 T	67 T
7	Normal portion of Thomson	33 T	136 T	63 T	191 T	161 T	584 T
8	tree 14-23-9	15 T	28 T	55 T	177 T	41 T	316 T
9	Limb variation of the Pear Shape strain in Washington	0 P	20 P	68 P	218 P	69 P	375 P
		8 W	25 W	2 W	17 W	15 W	67 W
10	tree 5-6-9	2 P	7 P	42 P	168 P	51 P	270 P
		3 W	13 W	42 W	69 W	28 W	155 W

P indicates fruits classed as characteristic of the Pear Shape strain, T indicates those of the Thomson strain and W, those of the Washington strain.

BREEDING AND GEOGRAPHY—Concluded from Page 115

tries, sugar, condiments, and tobacco, fibers, textiles, and clothing, etc. Under wheat, some three pages are devoted to the introduction and breeding of new varieties. Also, in the discussion of sugar the important rôle of breeding in the development of the sugar beet is emphasized. In the chapter *The Expansion of Industries,* one notes especially the appreciation by the author of value of plant breeding, plant exploration and plant introduction. He states "Plant breeding is a force that is transforming agriculture as the steam engine has transformed transport and the factory." He emphasizes especially the breeding of tree crops. This chapter is especially to be recommended to the readers of this Journal.

The author has demonstrated that a discussion of the breeding of plants and animals rightly belongs in such a text. The reviewer, therefore, suggests that in the next revision a summary of breeding results and a view of the possibilities of breeding be included in the consideration of each plant and animal industry.

Geneticists can hardly follow Professor Smith when he states (p. 5): "It is a common mistake of the historian to give the idea that peoples have certain qualities inherently. It is much more correct to say that primitive or savage peoples are primitive or savage because of the niggardliness or peculiarities of nature's gifts to the land in which they happen to live, rather than because of bad qualities which they may inherently possess. The environment, in making the race, has developed the qualities out of the fundamental and universal human nature." Rather, geneticists have secured evidence that, inherently, individuals do vary greatly in physical and mental qualities. Different peoples differ in the proportion of the abler and less able within their groups. However, just how to evaluate the influence of environment in nullifying or bringing out good qualities and how to establish the best environment in order to measure inherent ability exactly, psychologists are a long way from discovering.

George M. Darrow.